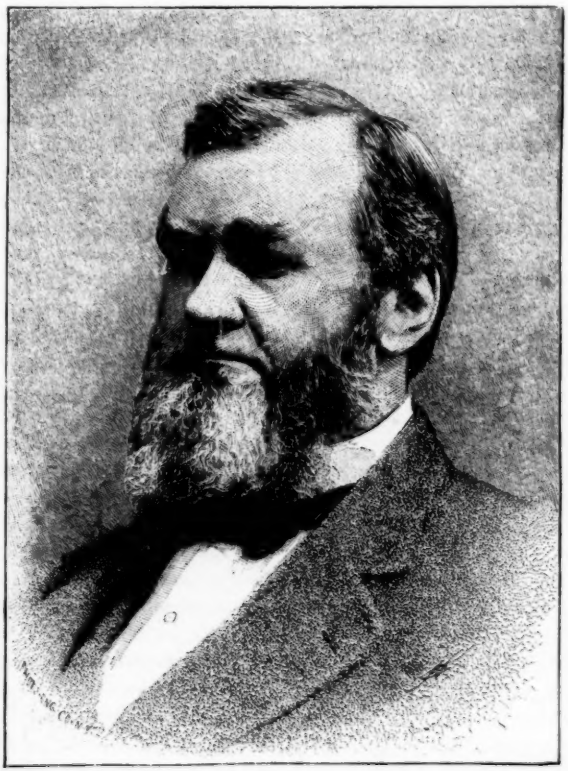
FRIDAY, MARCH 9, 1883.

SPENCER FULLERTON BAIRD.[1]

THE ancestors of the present secretary of the Smithsonian institution were of English, Scotch, and German origin. The grandparents were Samuel Baird of Pottstown, Penn., and Rebecca Potts. Their son Samuel was a lawyer established at Reading, Penn., where Spencer Fullerton Baird was born Feb. 3, 1823. His great-grandfather on his mother's side was the Rev. Elihu Spencer of Trenton, whose pulpit-eloquence during the war for independence brought him the honor of having a price set on his head by the Britis government.



Samuel Baird was a man of fine culture, a strong thinker, close observer, and lover of nature and out-of-door pursuits. He died in 1833; but his children, especially his sons William and Spencer, were largely influenced by their father's tastes, and early began the collection of specimens in natural history. They worked together; and there are still, in the museum at Washington, specimens of birds prepared by these boys forty-five years ago, by a simple process of evisceration, and then of stuffing the body-cavities with cotton and arsenical soap. The older brother entered the legal profession, and at the time of his death, in 1872, was U. S. collector of internal revenue at Reading.

The younger continued his studies and natural history pursuits without interruption. He entered Dickinson college in 1836, when only thirteen years old, and was graduated in 1840. He afterward carried on some studies in medicine, but never formally completed the course, and received his degree of M.D. *honoris causa*. His early interest in natural history was steadily encouraged and fostered. He was not compelled into a profession, but allowed to exercise the fullest freedom in researches and collections. A strong stimulus was in the friendship of Audubon, which he formed as early as 1838, while he was still a student in college. He was only prevented by ill health from accompanying Audubon as his secretary on his six-months' expedition to the Yellowstone in 1840. The older naturalist, in 1842, gave the younger the greater part of his collection of birds, including most of his types of new species. It was in these early years, also, that he formed

[1] For the portrait of Professor Baird, here given, SCIENCE is indebted to the liberality of the Photo-engraving company of New York.

lifelong friendships and associations with George N. Lawrence, John Cassin, John G. Morris, Thomas M. Brewer, and S. S. Haldeman.

In 1846 he was chosen professor of natural history in Dickinson college, and the next year accepted the additional work of chemistry. He remained in this position until 1850, declining a call, which he received in 1848, to a corresponding chair in the University of Vermont. His college-work included instruction of the seniors in physiology, of the sophomores in geometry, and of the freshmen in zoölogy; but the period was one, also, of great activity in collection and research, and in the beginning of his extensive publications. He found time to carry on the work begun in previous years, and to make, in summer, extended collecting expeditions to the Adirondacks in 1847; to Ohio in 1848, to collect, in company with Dr. Kirtland, from the original localities of the types of the fishes described by him in his work on the fishes of Ohio; to the mountains of Virginia in 1849; and to Lakes Champlain and Ontario in 1850. His fine physique and consequent capacity for work is doubtless due in part to his out-door life during these years. In 1843 he made pedestrian collecting-tours, the length of which was over 2,200 miles.

The first printed paper which bears his name is a description of two new species of fly-catchers, which was published in the Proceedings of the Philadelphia academy of natural sciences in 1843. As early as 1846 he was engaged in the preparation of a synonymy of North-American birds; and the next year he met Agassiz, just arrived from Switzerland with Desor and Girard. Then, or shortly after, was projected the work of Agassiz and Baird on The fresh-water fishes of the United States, which was, however, never published; although a number of illustrations, and some pages of text, were elaborated. Just before leaving Dickinson college, he undertook his first considerable literary work, — that of translating and editing the text for the Iconographic encyclopaedia, which was an English version of Heck's Bilder-atlas, published in connection with Brockhaus's Conversations-lexikon.

The work which he had already done had called attention to his scientific qualifications; and in 1850, upon the urgent recommendation of the late George P. Marsh, he was invited to Washington as assistant secretary of the Smithsonian institution, where he has ever since remained, succeeding to the secretaryship in May, 1878, upon the death of Professor Henry. The institution was then just issuing the first volume of its Contributions, and was in the first years of its organization. The main duty of the assistant secretary was the development of the natural-history collections. The only specimens in possession of the institution at the time of Professor Baird's arrival were a few boxes of minerals and plants. Professor Baird deposited his own already extensive collections, and these formed the nucleus of the Smithsonian museum. The collections of the Wilkes exploring expedition, which constitute the legal foundation of the United States national museum, were at that time under the charge of the National institute; and although, by the act of incorporation, the Smithsonian institution was the legal custodian of the 'National cabinet of curiosities,' it was not until 1857 that the regents finally accepted the trust, and the national museum was definitely placed under the control of the Smithsonian institution, and transferred to its building. Until this time, Congress had granted no funds for the support of the Smithsonian cabinets, and the collections had been acquired and cared for at the expense of the endowment fund. They had, however, become so large and important in 1857, that the so-called national collections at that time acquired were small in comparison.

The national museum, then, had a double origin. Its actual, though not its legal, nucleus was the collection gathered in the Smithsonian building prior to 1857. Its methods of administration, which were, in fact, the very same that had been developed by Professor Baird as early as 1845, when forming a cabinet in Carlisle, are those which are still in use, and

have stood the test of thirty years without any necessity for modification. In all this work Professor Baird and Professor Henry worked in harmony; and Professor Baird, since his succession to the secretaryship, has carried forward the same general system.

The growth of the museum has been very largely due to the scientific explorations which have been organized by the Smithsonian institution. The first grant ever made by the institution for scientific exploration and research was in 1848, to S. F. Baird, for the exploration of the bone-caves and the local natural history of south-eastern Pennsylvania. The direction of these explorations came at once under the duties of the assistant secretary, and remained throughout under his immediate care. In his reports to the secretary, published year by year in the annual reports of the institution, will be found the only systematic record of government explorations which has ever been prepared. The policy of the institution has, as is well known, always been to do such work as no other institution was able or willing to undertake. From 1850 to 1860 several extensive government expeditions were sent to the western territories; and it became the duty of Professor Baird to enlist the sympathies of the commanders of these expeditions in the objects of the institution, to supply them with all the appliances for collecting, as well as the instructions for their use. In most cases, also, he organized the natural-history parties, nominated the collectors, employed and supervised the artists in the preparation of plates, and in many instances edited the zoölogical portions of the reports. The fitting-out of such expeditions was only a small part of the work. From the beginning until now there have been thousands of private collectors who have derived their materials, their literature, and, to a considerable extent, their enthusiasm, from the Smithsonian institution. The Smithsonian 'instructions to collectors,' which has passed through several large editions, and many specific circulars of a similar character, were prepared by Professor Baird in connection with this department of his work.

In addition to this, the assistant secretary had from the outset the charge of certain departments of the routine work of the institution. The system of international exchanges, for instance, which had been one of the leading objects of the Smithsonian institution, was organized by him in its main details. Already, in connection with his private enterprises, he had developed a somewhat extensive system of exchanges with European and American correspondents; and the methods thus developed were expanded for the wider needs of the institution. His first task, after entering upon his duties, was to distribute the second volume of the 'Smithsonian contributions to knowledge;' and his hand may be seen in all the subsequent operations of this department; for the active oversight which he gave to the collecting and distributing work of the institution has not prevented him from continuous literary work. The extent of his contributions to science and scientific literature will be more readily seen after the publication of a bibliography of his writings, which is now in press, and will soon be issued as one of the bulletins of the national museum. The list of his works is complete up to the end of the year 1882, and contains 1,063 titles. Of this number, 775 are brief notices and critical reviews contributed to the Annual record of science and industry while it was under his editorial charge, 31 are reports relating to the work of the Smithsonian institution, 7 are reports as commissioner of fisheries, 25 are schedules and circulars officially issued, and 25 are volumes or papers edited. Out of the remaining 200, the majority are original contributions to scientific literature. Among the most elaborate of his original memoirs are the Catalogue of North-American serpents (1853), the Mammals of North America (1854), the Birds of North America (1858), the Review of North-American birds (1864–66), the Distribution and migrations of North-American birds (1865), and a History of North-American birds, in connection with Thomas M. Brewer and Robert Ridgway (1874). From 1870 to 1878 he was scientific editor of the periodicals

published by Harper & Brothers, and also edited their yearly cyclopaedia of science entitled the Annual record of science and industry.

Some idea of the scope of Professor Baird's work appears from the fact, that, of the total number of papers enumerated in the forthcoming bibliographical list, 73 relate to mammals, 80 to birds, 43 to reptiles, 431 to fishes, 61 to invertebrates (chiefly in the form of reviews), 16 to plants, 88 to geographical distribution, 46 to geology, mineralogy, and paleontology, 45 to anthropology, 31 to industry and art, 109 to exploration and travel. While the number of new species described does not necessarily afford any clew to the value of the work accomplished, it may be referred to as an indication of the pioneer work it was necessary to do, even in so prominent a group as that of the vertebrates. Among mammals there may be noted 49; birds, 70; reptiles, 186; fishes, 56. Forty-nine of two hundred and twenty, or nearly one-fourth of the mammals discussed in the Mammals of North America, were then described for the first time.

In 1871 Professor Baird was appointed by President Grant to the position of U. S. commissioner of fish and fisheries, — an unsalaried office, to the duties of which, for eleven years, he has devoted a large portion of his time. The literary product may be seen in the seven volumes of reports, and two of bulletins, issued by the commission; but the scientific results in research, and the economic results in stimulating a great industry, are difficult to measure. There has been a systematic investigation of the waters of the United States, and the biological and physical problems which they present; an examination of the methods of fisheries, past and present, and the statistics of production and commerce of fishery products; and an introduction and multiplication of useful food-fishes throughout the country, especially in waters under the jurisdiction of the general government, or those common to several states. The commission is an admirable illustration of the application to practical purposes of sound science.

The value set upon Professor Baird's scientific attainments is indicated by the various positions of trust to which he has been called, and the recognition which he has received from learned bodies. In 1850 and 1851 he served as permanent secretary of the American association for the advancement of science. In 1876 he served as one of the Government board of commissioners to the international exhibition at Philadelphia, and was also a member of the international jury. In 1877 he was present as advisory counsel at the sessions of the Halifax fishery commission, and, since 1878, has been one of the trustees of the Corcoran gallery of art in Washington; he has been president of the Cosmos club, and for many years a trustee of Columbian university. In 1856 he received the degree of doctor of physical science from Dickinson college, and in 1875 that of doctor of laws from Columbian university. He was, in 1878, awarded the silver medal of the Acclimatization society of Melbourne; in 1879, the gold medal of the Société d'acclimatation of France; and, in 1880, the 'erster ehrenpreis' of the Internationale fischerei ausstellung at Berlin, the gift of the emperor of Germany. In 1875 he received from the king of Norway and Sweden the decoration of 'knight of the royal Norwegian order of St. Olaf.'

He was one of the earliest members of the National academy of sciences, and has for many years been a member of its council. Besides honorary relationship to many scientific societies in the United States, he holds a foreign membership in the Linnaean society and the Zoölogical society of London, and a corresponding membership in the K.-k. zoologisch-botanische gesellschaft (Vienna), the Sociedad de geographia (Lisbon), the New-Zealand institute, the Koninklijke natuurkundige vereeniging in Nederlandsch-Indië (Batavia), the Magyar tudomanyos akademia (Budapest), the Société nationale des sciences naturelles (Cherbourg), the Academia Leopoldino-Carolina naturae curiosorum (Jena), the Naturforschende gesellschaft (Halle), the Naturhistorische gesellschaft (Nuremberg), the Geographical society of Quebec, the Deutsche fischerei verein (Berlin).

METEORIC AND TERRESTRIAL ROCKS.

AN unavoidable delay in the completion of the plates of a work to be published in the memoirs of the Museum of comparative zoölogy has rendered it advisable to publish in advance a brief abstract of some of the results thus far obtained. The work will contain descriptions of the microscopic characters of meteorites and the allied rocks; their classification; collected and arranged chemical analyses; a discussion of the principles of classification; the origin of rocks; the present and past state of the earth in its bearings upon petrography, etc.

The previous delays in the publication of this work have been owing to other labors, a change of plan greatly extending its scope, and the fact that work of the proposed character is vastly more difficult than simply 'pigeon-holing' rocks in different species, according to the minerals they happen to contain.

The results which it is desired to present here are as follows: —

1. Petrographical research demands a former liquid globe, and one whose interior portions are either now liquid, or in such a condition that they can readily become so.

2. That the interior of the earth is now probably liquid, is shown not only from petrographical and geological research, but also by the fact that the best and more recent observations either prove or render it probable that iron and such rock materials as are believed to compose the *infra*-sedimentary portion of the earth are lighter when hot-solid, at or near the melting point, than they are at about the same temperature when liquefied. Hence, according to Thomson's law, pressure lowers their fusing point, instead of raising it.

3. No sinking of the earth's crust to the centre could take place; for, since the interior is heterogeneous, the crust on sinking would meet with material of higher specific gravity, the heat imparted to the sinking matter would cause it to grow lighter, and the viscosity of the material still liquid would retard its descent.

4. All so-called physical and mathematical demonstrations of the earth's solidity have been based on certain hypothetical globes of unlike constitution with the earth; and hence have not the slightest application to it, but to the hypothetical globes only.

5. All rocks originally came from the cooling molten material of the globe, and the chemical and sedimentary rocks have resulted from the disintegration of that material.

6. All eruptive or volcanic (including plutonic) rocks were derived from material which either had never solidified, or had been reliquefied; but they were not derived from sedimentary or chemical deposits.

7. In the shrinkage and fracturing of the earth's crust, the depression of any portion into the still molten interior would naturally displace and cause the heavier liquid to overflow, just as the fracturing and depression of ice causes the heavier water to overflow it.

8. Water is the accident of an eruption, and is not the cause. It is met by the lava on its way to the surface, but is not the cause of the advance towards that surface. Hence it is probable that explosive volcanic action has become more common in recent times, while quiet outflows were more abundant in past ages.

9. Regions of crystalline rocks are, as a rule, regions in which eruptive, or mixed eruptive and sedimentary, agencies have prevailed, and are of every geological age, — meaning, by eruptive agencies, the original and secondary results of a cooling globe, including thermal waters. Metamorphism is even more common in eruptive than in sedimentary rocks.

10. The original rock-materials of the universe are the same, from whatsoever region they come, and the same principles should be employed in classifying them; while the classification, to be natural, ought to express their relationships.

11. A natural classification of rocks should be based on all their characters taken as a whole. It must be an empirical one, as in zoölogy and botany; and ascertained by studying all known forms, and arranging them according to their petrological, lithological, and chemical characters, — taking the rocks as a whole, and considering all their relations.

12. The present received classifications of rocks are artificial, based on part of the characters to the exclusion of others; they correspond to the Linnean artificial botanical classification, and hold about the same relations to a natural classification of rocks as that does to the natural classification of plants.

13. The great mass of rocks separated from one another as distinct species in these classifications are mere varietal forms of certain definite natural species, — the variation owing to alteration, or to some little change in conditions.

Distinction should be made between superficial weathering and the chemical and molecular changes that go on in all eruptive rocks after

consolidation and exposure to the action of infiltrating waters: that is, changes in the rock-mass as a whole; a change from an unstable to a more stable condition, — a loss of energy.

14. The original or eruptive rocks of the universe form a continuous series from the most basic to the most acidic; but for convenience they are to be divided into definite species or groups.

15. The preponderance of characters, and not the presence or absence of any one mineral, ought to decide the place of any rock in the system, yet the latter is the fundamental basis of the received lithological classifications. The original characters of the rock ought to hold priority in classification over any secondary characters.

16. Geological age has no bearing on classification, beyond this: that the older the same rock is, under like conditions, the greater is its alteration. The greater number of the so-called rock-species of pre-tertiary age are the altered forms of rocks which were once identical with tertiary and modern rocks.

17. A natural classification, in its broader applications, can be employed in the field as well as in the laboratory; for, as a rule, all the characters of rocks are so related to one another, that from one set the others can be inferred with a fair degree of accuracy.

18. When complete (*bausch*) analyses are made of typical rocks, rock-species are believed to have in their broader features certain limits of chemical composition outside of which the normal forms rarely go, and inside of which the normal forms of other species rarely come; but the mineralogical composition is more or less unstable and variable, depending upon alteration and other conditions to which the rock has been subjected. The chemical relations of rocks would be much better shown if the percentages were expressed in terms of the elements, instead of their compounds.

19. All rocks, except meteoritic and recent volcanic ones, are more or less altered; and it is from these altered rocks that the received classifications and the principles of classification have been chiefly based in Europe, — unaltered rocks being apparently limited there to the few active volcanoes.

20. Fragmental or derived rocks should be classed, as far as possible, under the rocks from which they were derived.

21. The relation of a rock to its associated rocks in the field is the principal criterion for determining its origin. This is especially the case in the altered rocks.

As examples of my meaning, it may be pointed out that the gabbros are here regarded as basaltic rocks lying near the peridotites; melaphyrs and diabases are principally altered basalts, but some rocks so classed are altered andesites; the porphyrites, principally altered and older andesites, but part are more acidic rocks; the propylites, with few exceptions, are andesites which are less altered and younger than the porphyrites; diorites, more or less altered forms of basalts, andesites, etc.; the quartz porphyries and felsites, principally old rhyolites; the nevadite is largely a vitreous rock, and belongs rather with the trachytes than with the rhyolites; kersanton, to the gabbros; minette, partly to the basalts and partly to more acidic rocks; the augite porphyries, partly to the basalts and partly to the andesites; the phonolites, partly to the trachytes, and partly to the andesites; and so on. Many schistose rocks are also formed by the alteration of eruptive rocks.

The position to which any rock should be assigned depends upon its affinities; and, in the above, the determination is based on such specimens as have been seen, which had been named by other lithologists. It is not intended to claim that every rock called by a particular name belongs in the position here assigned that name.

In applying the principles and methods given here, in the bulletin of the Museum of comparative zoölogy, and in the proceedings of the Boston society of natural history, the writer has been led to classify the meteorites and the large but comparatively unknown series of terrestrial rocks that are more basic than the basalts, as follows: —

1. *Siderolite.* — In this species or group are included a series of rocks composed chiefly of iron, either native or in its secondary states, with or without nickel, schreibersite, pyrrhotite, graphite, etc. It includes all masses of iron or iron-ore that have fallen as meteorites, those that can be shown to be original or eruptive portions of the earth, or directly derived from them; i.e., fragmental deposits. No veins or chemical deposits of iron-ore are included. The analyses of this species are imperfect; for they do not, as a rule, convey an idea of the composition of the rock-mass, but rather of the component minerals, especially of the iron. It is much as if a chemist should analyze magnetite from basalt, granite, and rhyolite, and then consider his analyses as typical of the rocks from which they were taken. When a larger number of analyses have been made, showing the composition of

these rocks as a whole, it is possible that they can be divided into more than one species. As the analyses stand, the rock is composed of iron, either native or combined, with or without varying amounts of nickel, cobalt, tin, copper, sulphur, titanum, phosphorus, silica, graphite, etc. The specific gravity is high. The presence of graphite shows that it is not of organic origin in this case.

Many of the so-called meteoric irons are probably of terrestrial origin, and their environment ought to be carefully studied. The Wiedmanstattien figures are in some measure paralleled by the leucoxene and cleavage structure of titaniferous and magnetic iron in diabases, etc.

The name 'siderolite' was formerly given by Maskelyne to the species to which G. Rose had previously given the name 'pallasite'; hence, since the latter has the prior right, it is hoped that Maskelyne will allow the transference of the term 'siderolite' as his own, to this species, to which it most properly belongs, since its individuals are emphatically rocks of iron.

2. *Pallasite.* — This species is formed from a series of rocks of like origin to the preceding; and the structure is that of a sponge- or semi-sponge-like mass of iron, either native or secondary, holding silicates. The iron has the associations usual in siderolite; and this association holds good wherever the iron occurs in meteorites, and probably on more careful study will be found to hold good, to a great extent, in terrestrial rocks. The silicates are principally olivine alone, or in association with enstatite and diallage. More rarely feldspar and other silicates occur. There are but two or three complete analyses of the pallasites that can be regarded of value; Joy's [*Amer. journ. sc.*, 1864 (2) xxxvii. 243–248] being the best yet made. The silica increases in amount, up to some 30%, averaging about 20%, with variable quantities of magnesia, rarely exceeding 24%; while the remaining constituents are chiefly iron and its associates. Specific gravity less than in the siderolites.

Under pallasite are classed the supposed meteorites of Atacama, Bitburg, Brahin, Breitenbach, Krasnojarsk, Potosi, Rittersgrün, Rogue River, Sierra de Chaco, Singhur, and more doubtfully those of Hainholz, Mejiellones, and Lodran. Of terrestrial rocks under the pallasites belong the olivine-magnetite rocks of Cumberland, R.I., and Taberg, Sweden; for which, as a varietal form, I would propose the name 'cumberlandite'. It is probable that many other pallasites will be found on careful investigation of the iron-bearing rocks. Some schistose rocks (actinolitic) are probably the result of the extreme alteration of the cumberlandite.

The Ainsa and Carlton meteorites from Tucson have a fine sponge structure, and contain numerous olivine. (?) grains; but, although they approach the pallasites, they have been classed with the siderolites.

3. *Peridotite.* — This term, applied by Rosenbusch to the pre-tertiary terrestrial olivine rocks, I would extend to all terrestrial rocks and meteorites of a similar composition, — including every thing from the pallasites to the basalts. These rocks are composed principally of silicates and iron; the former preponderating, and the latter sometimes wanting. The silicates are principally olivine, enstatite, and diallage or augite, and sometimes feldspar. The iron is either native, or in the form of pyrrhotite, magnetite, chromite, etc. Silica and magnesia are more abundant, as a rule, than in the pallasites, and less so than in the basalts, while the iron is less than in the former. The specific gravity is also intermediate between the two above-mentioned species.

If it is desired, similar varieties can be pointed out in the meteoric peridotites as in the terrestrial forms; as, for instance, dunite (Chassigny), olivine-enstatite rock (Iowa Co., Knyahinya, Gopalpur, Lancé, Tourinnes, Waconda, Goalpara), lherzolite (Pultusk, Estherville, New Concord, etc.). Also, if desired, an olivine-enstatite-augite division can be made (Tieschitz, Hungen, Grosnaja, etc.).

While part of the meteoric peridotites are entirely crystalline, e.g., Estherville, the great majority are not so, but chondritic in structure. The chondritic structure I believe to be caused by the rapid solidification and arrested crystallization of the masses composed of minerals naturally taking a more or less rounded form; and not from mechanical action, as has generally been claimed. These chondrae show, as a rule, a light or dark gray finely fibrous or fibrous-granular base and semi-base, answering to the globulitic base of the basalts or the felty base of the andesites. This base has heretofore been described as a flocculent opaque-white material, a cloudy substance, the comminuted material, the feldspathic material, etc. Sometimes it is isotropic; but more commonly it affects polarized light according to the amount of olivine or enstatite granules formed in it. When crystallization goes far enough, these granules form by their union the enstatite and olivine grains and crystals.

The base united with the olivine or enstatite gives the structures which have been taken by Drs. Hahn and Weinland as of organic origin. I should expect to find the chondritic structure in terrestrial peridotites, if any can be found in which the crystallization had been arrested and subsequent alteration has not taken place.

The difference in structure between the rapidly solidified, or chondritic, and the crystalline peridotites is not any greater than that between the tachylitic, basaltic, doleritic, or diabasic state of the basalts.

All serpentines not veinstones, which have been carefully studied, appear to belong to peridotite, as a variety produced by alteration.

4. *Basalt.* — To the basalts I should assign such meteorites as those of Jonzac, Stannern, Constantinople, Petersburg, Juvenas, Shergotty, Charkow, Frankfort, Shalka, Massing, Busti, Manegaum, Ibbenbüren, etc., so far as their characters are at present known. These have a lower specific gravity than the preceding, a higher percentage of silica, less iron and magnesia, but more lime, and usually more aluminia.

Some of these meteorites, like the Shergotty and Manegaum ones, are apparently allied to the gabbro variety of basalt.

Beyond the basalts are a few imperfectly investigated forms, which, in the majority of cases, are regarded as doubtful meteorites, which appear to belong to the trachytes and rhyolites, but which require to be studied microscopically before definite statements can be made. Of these forms are some described by Shepard, Silliman, and Grewingk. The carbonaceous meteorites have been too little studied to be given a definite position yet; but, excepting the carbonaceous matter, they chemically appear to belong to the peridotites, although it is not improbable that they belong to a distinct species.

So far as studied, I would class the meteorites, the original and eruptive rocks, under the following species: 1°, siderolite; 2°, pallasite; 3°, peridotite; 4°, basalt; 5°, andesite; 6°, trachyte; 7°, rhyolite; 8°, jaspilite.

If further study shows that other species are needed, then the signification of any of the groups from which the new species are taken can easily be narrowed. As many varietal names can be employed under each species as the needs of the science may demand; but they should be as few as possible, and should hold the same relation to the species that the varietal names of quartz hold to the mineralogical species quartz.

This classification is intended to indicate the probable arrangement of materials in the earth from the interior outwards, beneath the sedimentary formations, as well as to connect, as far as possible, the sedimentary rocks with those from which they were derived.

Meteorites show, to my mind, characters indicating that they have been derived from a hot, liquid mass, and not from any gaseous or solid body, so far as concerns the portion they come from. Of all suggested sources, the most probable one is the sun, provided the eruptive activity now observed on his surface is sufficient to hurl such materials into space; if not now, in past times, when such action was more powerful; or else bodies of similar nature. Meteorites, as far as I have studied them, show no fragmental or tufaceous character beyond such as would be formed by hot, plastic drops falling into a liquid mass of the same material.

They also show that they have not been formed in a locality where life could have existed; for, in that case, the readily alterable materials of which they were composed would have suffered change. M. E. Wadsworth.

MOLLUSKS OF THE FAMILY COCCULINIDAE.

Examination of specimens of a Cocculina or an allied genus of that family, from the north Atlantic, shows some remarkable features. These mollusks, recently discovered by the U. S. fish-commission in the deep sea, are most nearly related to the keyhole limpets (Fissurellidae). The specimens obtained by Prof. Verrill, and examined by me, were, however, all females. A number of specimens, of another species, sent me by Dr. Jeffreys for examination, contained individuals of both sexes; and the males were found to possess a verge, permanently exserted from the inner side of the right tentacle. This is a feature hitherto entirely unknown in the order to which they belong, none of the littoral forms of any of the families possessing any such organ; though, like other limpets, dioecious. It is of course probable that the species of Cocculina found by the fish-commission and Prof. A. Agassiz agree in this character with the form from the north Atlantic, about to be described by Dr. Jeffreys; but the latter shows other differences which may require it to be subgenerically separated from Cocculina proper, though evidently a member of the same family. Wm. H. Dall.

THE PRESENT CONDITION OF EXPLORATION.

THOSE readers who wish to follow the reports and news of explorations in distant lands may find some assistance in the following condensed statement concerning the more important recent expeditions in the uncivilized parts of the world. We here note those travellers who have lately completed their field-work, and returned home, and whose narratives are recently published or still awaited; those who are still in the field, from whom occasional reports are received, often only after a time of trying silence; and those who are now planning to enter new ground.

Arctic regions. — The situation of parties in the arctic regions at the beginning of 1883 is about as follows, as far as known. Of the *Jeannette* expedition, the remainder of the original party were about to begin the homeward journey, together with ensign Hunt of the *Rodgers*. At last accounts they were *en route* from Irkutsk to Orenburg. Messrs. Harber and Schutze of the navy were expected at Irkutsk, in April, with the remains of DeLong and his party, intending to start for home as soon as the caskets arrived. A bill has been introduced into Congress to pension Mrs. DeLong; and another to indemnify those who lost personal effects on the arctic expedition of the *Rodgers*, and to reward the friendly natives who preserved the lives of the party during the winter after the burning of the ship. Mr. Leigh Smith of the *Eira* expedition has presented the Geographical society of London with £1,000, in recognition of its interest in arctic work. The arctic exploring vessel *Dimfna*, commanded by Lieut. Hovgaard of Nordenskiöld's party, bound for Cape Cheliuskin or Franz Josef Land, was beset in the Kara Sea, near Kara Strait, in the latter part of August. Several propositions have been made to organize an expedition for the purpose of communicating with her and with the Dutch international meteorological party on the *Varna*, also impeded by ice in the same vicinity. As nearly as can be judged from rather confused telegrams which have been received, no relief-party has actually been organized; though correspondence between the Danish and Dutch authorities has taken place, and the Danish captain Normann has visited St. Petersburg on that business. It has been reported that Larssen, one of the *Jeannette* survivors, had been engaged to make the attempt; and the last news appears to be, that nomads from the Petschora river-mouth report that the vessel was in good order, and had arrived from the coast of Novaia Zemlia to remain for the winter.

The situation at the international polar stations for simultaneous meteorological and magnetic observations was favorable when last heard from, except in the case of the Novaia Zemlia parties. The American station at Lady Franklin Bay, the most northern and the first-established of all, has not been communicated with, owing to ice in the northern part of Smith Sound; but, being fully provisioned and equipped for three years, the party are believed to be in good condition. The German station at Kingava, Cumberland Inlet, was successfully established in the autumn of 1882, under Dr. William Giese. Observations are in progress at Godhaab, in West Greenland, under Lieut. Paulsen's direction. Dr. Snellen in the *Varna*, with the Dutch expedition which aimed at reaching Dickson Haven, near the mouth of the Yenisei, reported beset in the Kara Sea, near Kara Strait, in the last week in August, will doubtless have established a station on the land of Novaia Zemlia if not released by the end of the season. With or near them was the Danish arctic expedition, on the steamer *Dimfna*, commanded by Lieut. Andreas Hovgaard, mentioned above. The Austrian expedition, commanded by Lieut. E. v. Wohlgemuth, succeeded in establishing its station by Aug. 15, on the island of Jan Mayen, in a ravine on the southern slope of the Vogelberg, named Wilczek valley, after the promoter of the expedition. The latest data from the Russian expedition to make a station at the mouth of the Lena was, that all was progressing favorably, and that the party, under the command of Lieut. Juergens, had reached its destination. Of the subsidiary station, projected by the imperial geographical society at Moller Bay, under the direction of Lieut. Andréieff, no positive news has been received here; but it is asserted that they had reached and would winter in Novaia Zemlia. The Finnish station on the shores of the White Sea began operations Aug. 15. Mahlenberg, with the Swedish expedition, were safely established at Wyde Bay, Spitzbergen; while the observations of Steen, at Bosekop, near the North Cape of Norway, have been going on quietly for some time. Capt. Dawson with his party were well on their way toward Fort Rae, in the Hudson Bay territory, when last heard from. The exact locality finally decided upon by the Anglo-Canadian party is not yet known. The U. S. party at U'gla-ámi, near Point Barrow, Alaska, were visited and recruited during the

summer, and the first year's observations are already in the computer's hands; while the simultaneous observations by self-registering instruments under the direction of Mr. Marcus Baker of the U. S. coast-survey, at Los Angeles, Cal., are progressing favorably, and will be steadily maintained. Of the proposed subordinate stations at York Factory and in Labrador, no recent information is at hand, though Dr. Koch, charged with organizing the latter, is stated to have reached Labrador in August.

In the antarctic, parties are believed to be already at work on South Georgia and the Falkland Islands; but details in regard to these stations are not yet received. The French station at Orange Bay, Tierra del Fuego, made a successful beginning of operations Sept. 6.

Alaska. — Little was doing in Alaska at latest advices. A prospector named Bennett, with a small well-armed party provisioned for fifteen months, had entered the valley of the Atna or Copper river to search for minerals. Edward Schieffelin, with his party and steam-launch, reached the junction of the Yukon and Tananah rivers during the summer, and were reported in good condition and spirits, intending to ascend the Tananah and search for gold. After the ordinary means of communication were closed for the season, it appears that discoveries of such importance were made that it justified the expedition of a special courier overland to carry the news to others interested in the venture. The route and details of the journey are not stated; but a letter, apparently authentic, and stated to have been so sent, has been published in the Californian papers, indicating that they had found very rich placers.

The U. S. coast-survey steamer *Hassler* has arrived in San Francisco, after six months' work in Alaska, having made important surveys, and is expected to return to the field in April. Valuable collections were made for the national museum during the voyage. Miners whose movements are not made public are pushing private explorations in many parts of the territory. From the small mining-camp of Juneau, the express companies note the receipt of $240,000 in gold-dust in 1882, against $13,000 in 1881. Capital, which alone can test the permanent value of these discoveries, patiently waits for the long-deferred extension of law and authority over the country by Congress.

South America. — The interior of British Guiana has lately been visited by H. Whitely, who passed near the celebrated mountain Roraima; and by M. McTurk, who travelled up the Cuyuní river toward the Venezuelan frontier. In the valley of the Amazon, R. Payer, brother of the Arctic explorer, was last reported on the Rio Negro, aiming for the Orinoco. J. B. Minchin has executed surveys of the Andean tableland south of Lake Titicaca for the Bolivian government, of which some account has been published; and J. Ball has followed Whymper in visiting the Andes for mountaineering. Dr. Crevaux, who left Buenos Aires Nov. 20, 1881, to ascend the Rio Pilcomayo, was killed there by the Indians in April of last year; but little has been learned of his expedition, and Fontana left Buenos Aires July 4, to search for the remains of the unfortunate party. It is reported that Lieut. Guierre, of the French marine, has undertaken a similar expedition. R. Lista, already successful in Patagonian exploration, is engaged on a journey from Bahia Blanca westward to the Andes, thence southward to Punta Arenas on the Straits of Magellan; and a government commission is occupied with the survey of northern Patagonia, to parcel the land for sale to colonists. Lieut. Bove of the Italian antarctic expedition was wrecked on Tierra del Fuego May 31; his vessel was lost, but the members of the party were rescued by an English vessel. The German south polar expedition was safely left on South Georgia Sept. 3; and the French expedition arrived at Tierra del Fuego on Sept. 6. The several astronomical parties sent to southern South America to observe the transit of Venus will probably return with new geographic observations as well; Steinmann, of one of the German parties, intends making an extended tour through Chili and Bolivia before coming back.

Asia. — The Russians continue an active exploration of their vast dominions. Besides extended surveys in the better-known parts of their country, Elisseieff has been examining Russian Lapland, Ivanitzky has been sent to the Petchora, Malakoff to the Ural, and Walter to Eastern Russia; Poliakoff has recently returned from the island Sakhalin, and Regel is still in the Pamir; surveys are carried on in Caucasia, and along the Persian boundary, where Lessar's recent studies have received much attention. It is proposed to send Preievalski, who has so successfully penetrated central Asia, back to the Tian Shan in March, to study its reported volcanic districts. Capus and Bonvalot, leaders of a French scientific party, have returned from Bokhara; and O'Donovan, an English correspondent, has come safely out of Merv with an interesting experience. Exploration in Asia Minor is largely archeological, and engages Humann,

Hirschfeldt, Fester, and Puchstein, who are aided by funds from Berlin, and Clarke, of our own Assos expedition; and parties from Vienna and from England will probably soon take the field, the latter under Conder to be fitted out by the British association for a survey of eastern Palestine. S. Langer, a young German, who had for some time been studying Arabic in preparation for an inland journey, was killed in southern Arabia last June.

Colquhoun and Wahab have safely finished a journey across country from Canton to Rangoon, where they arrived last July; the latter unhappily died on his way to England. The French are sending many parties into Indo-China, a field that few other nations attempt; Garanger has gone to upper Burma; Villeroi d'Augis has returned from Tonquin, but his companion, Courtin, died in the interior; Harmand has entered Siam; Néis, Aymonnier, Septans and Mondon, and Gautier, have gone to Cambodia and Cochin China, the latter expecting to make an extended journey. C. Bock, known for his travels in Borneo, returned to Bangkok from a trip in upper Siam last June. Riebeck had a successful ethnological tour in northern India, and has gone to Batavia; he will return to Europe by way of this country.

Africa receives the lion's share of modern exploration, and largely with a view to commercial advantage. The French continue their energetic work in Senegambia. Col. Berguis-Desbordes, who was last year in command of a French government party on the upper Senegal, is to return with a strong force to the country between the Senegal and the Niger. A large railway corps under Jacquier will follow him. Dr. Bayol left Bordeaux last October for the Futa-Djallon highlands, and Caquereau was recently preparing a scientific and commercial expedition for the same region. Capt. Burton and commander Cameron returned last summer from the Gold Coast, where they had been to look into the chances of mining. A Russian expedition under Rogozinski, and an Italian under Bianchi and Licata, have been planned to enter the country at the Bight of Biafra. The latter will be absent several years, intending to cross the continent, passing through the unknown region between the Kongo, the Benue, and Lake Tchad, and finally reaching Abyssinia. No full report has yet been made on a similar long journey, but in the opposite direction, by Matteucci and Massari, on the return from which the former unfortunately died in London, August, 1881. Savorgnan de Brazza and Stanley have returned from their expeditions on the lower Kongo; Brazza reaching Europe last June, and Stanley in October. They have unhappily come back with little good-will for each other; and it would seem from the reports of their journeys, so far as yet published, that Brazza has been over-ambitious in his designs. Both are to return for further exploration. In addition to the trading-stations planted on the lower Kongo, several missions have established themselves there, and will probably contribute to our knowledge of the geography of the region. Bentley, Comber, and Grenfell, of the Baptist missionary society, have reached Manyanga and Stanley Pool; Clarke, Richards, Ingham, and Sims, of the Livingston (Kongo) mission, are established at Stanley Pool, and have two small steamboats for journeys up the river; L. Petit, a naturalist who has been along the Loango coast, is going up the Kongo; and Cambier, of the International African association, left Zanzibar last May, with two hundred men, for the Kongo *viâ* the Cape.

From the Egyptian Sudan, Emin-Bey and Lupton-Bey report on their explorations. Among the Italian explorers are Cecchi, lately returned from southern Abyssinia; Count Antonelli, who was to begin his work at the Italian colony Assab, on the Red Sea; P. Sacconi, to establish a trading-station at Harar, southwest of the head of the Gulf of Aden; and Capt. Casati, whom Dr. Junker has met on the Uelle. The latter is still in this little-known region, attempting to solve the problem of its drainage. The German African association at present has several exploring parties at work: Flegel, aiming at Adamaua, with hope of reaching the unknown country beyond between the Benue, Shari, and Kongo; Pogge and Wissmann, who entered from the west coast, and reached the upper waters of the Kongo, where they parted, — Pogge to return westward, and Wissmann to go on eastward to Zanzibar, where he safely arrived last November; and Stecker, who had been with Rohlfs in Abyssinia about Lake Tana, and who then attempted to go southward through the Galla lands to the coast. There is also a German expedition under Böhm, Kaiser, and Reichard, at Kakoma in Ugunda, and a Belgian station at Karema, where Storms has gone to relieve Becker; Dr. G. A. Fischer was to enter eastern Africa from Pangani last November, with an expedition fitted out by the Hamburg geographical society; he hopes to reach Victoria Nyanza, and then turn northward. The appropriation of 100,000 marks by the German Reichstag for African exploration is recently

announced. J. M. Schuver is south-west of Abyssinia, about the head-waters of the Blue Nile. Aubrey and Hamon, Révoil and Soleillet, are French explorers working inward from the Red Sea.

English exploration in the lake region is to be renewed under Joseph Thomson, who is sent by the Royal geographical society to explore Mounts Kenia and Kilimandjaro and the country beyond them. H. E. O'Neill, British consul at Mozambique, has lately undertaken several inland expeditions, and will be probably heard from again. Johnson, of the Universities mission, has recently shown that the Ludjende branch of the Rovuma heads in a lake supposed to correspond to Livingston's Shirwa. Many other missions have stations in the lake region. James Stewart has been sent to construct a road between Lakes Nyassa and Tanganyika. He had a steamer on the former, and has executed a survey of it.

A. Raffray, who had explored part of Abyssinia while French consul at Massaua, has been sent as consul to Tamatave on the eastern coast of Madagascar, where he will probably continue his geographic studies; Paiva de Andrada, with a company of experts, has examined the mineral riches of the lower Zambesi, but no full reports are yet made public; Giraud left Marseilles for Zanzibar last July, hoping to penetrate to Bangweolo lake and then west to the Atlantic; Cardoso and Franco left Mozambique in September last, to enter Umzeila's country; and Dr. Holub intends to return to south Africa early this year, prepared for a journey from the Cape to the Zambesi.

Australasia. — The government of West Australia has sent an expedition, under J. Forrest, to the north-western coast to institute surveys, as he had found valuable agricultural lands there in a previous trip. Michlucho-Maclay, who has spent a year in Europe after his long stay in New Guinea, returns to Sydney to continue zoölogical studies there. While in Europe, he received £2,200 from the emperor of Russia toward the publication of his previous explorations. Last March the Rev. W. S. Green accomplished the ascent of Mount Cook, the highest of the New Zealand Alps, with the aid of two Swiss guides. He proposed to attempt a similar excursion in New Guinea. Dr. Finch has returned from ethnological studies in Australasia and Oceanica. Schadenberg, Meyer, and Landau have been in the Philippines; and the latter goes to Japan. H. de Vésine, Larue, and M. Geny have undertaken an expedition in Sumatra.

As the reports and results of these various explorers are published, it is our hope to present an outline of them to the readers of Science.

THE WEATHER IN DECEMBER, 1882.

The monthly weather-review of the U. S. signal-service for December, 1882, shows that the meteorology of the month was of unusual interest. The following may be mentioned as the prominent characteristics: —

The temperature was below the mean in all districts east of the Rocky Mountains, except in the lower Missouri valley, and above the mean from these mountains to the Pacific. The lowest temperature noted was — 35°, in Dakota; and the highest, 95°, in Arizona. The cold was unusual in the southern states, there being frosts as far south as central Florida. The special frost warnings were of great value to the sugar and fruit growers in this section.

The rainfall reports, which were received from over five hundred stations, show in general a deficiency; but there was a marked excess in the northern Pacific district, causing floods in Oregon and Washington Territory. Snow in California on the 12th, causing considerable damage to the evergreen foliage, was the special feature of the precipitation record.

The average pressure was normal; but the depressions, as is usual in December, were well marked, ten being charted. Of these, one was observed from the Pacific to the Atlantic, and across the ocean to the English coast; one was formed by the union of two centres; while two presented the unusual phenomenon of separating each into two distinct centres, which afterwards re-united. Five of the depressions pursued an easterly track, and four a northeasterly. Four of the areas were traced completely across the Atlantic.

The wind velocities were often high; the greatest recorded being 116 miles an hour, at Mount Washington. Velocities of 70 miles were noted on the coast of North Carolina. The following 'total movements of the wind' in miles deserve note: Mount Washington, 23,411; Cape May, 12,901; Pike's Peak, 12,548; Hatteras, 12,279. The velocities at Mount Washington invariably exceed those of any other station, month after month; while those at Pike's Peak are smaller, though the elevation of the station is more than twice as great. In this month the velocity at Cape May, on the coast, exceeded that at Pike's Peak, over 14,000 feet in altitude.

Auroras were frequently noted, but none

were of special interest; earthquakes were reported in New Hampshire and California on the 19th, and in Maine on the 31st.

HISTORY OF THE APPLICATION OF THE ELECTRIC LIGHT TO LIGHTING THE COASTS OF FRANCE.

I.

THE value to navigation of thoroughly lighting our coasts is too evident to require any argument in its favor; and, in view of the immense interests at stake, there is no question but that improved methods of lighting should be adopted, almost regardless of expense, providing that the advantages gained are in any way commensurate with the cost.

France has long appreciated this; and it is to her that the world owes the Fresnel lens and many improved lamps burning successively whale, vegetable, and mineral oils. She has finally led the way, as usual, in the use of the electric light, which has been definitely adopted for the lighting of her coasts, after many expensive and conclusive experiments; and, when the plan has been fully carried out, France can boast of having the best and most systematic method of coast-lighting of any country in the world.

The United States has followed France. Our optical apparatus has been almost exclusively imported from that country. We use lamps made after French patterns, and now we are making experiments to determine its value for our lighthouses. This is deemed sufficient excuse for giving full details of the French system. The information has naturally been mostly obtained from French sources.

It was in 1863 that the electric light was for the first time used in lighthouses. The experiment was made with an Alliance machine in the first-order lighthouse of la Hève, near Havre; and the results were so satisfactory that doubtless all the lighthouses would have been immediately furnished with electric lights, had it not been for the great expense attending a general alteration. It was proved that the electric light was seen about eight kilometres farther than the oil-light, and that, in time of fog, the range of the former light was more than double that of the latter.

M. Quinette de Rochemont, ingénieur des ponts et chaussées, published in 1870 a report upon the lighthouses at la Hève. Below are some extracts: —

"The electric light having been installed for six years at la Hève, enough time has elapsed to allow us to form an exact idea of the value of this means of producing light for the lighting of coasts. Sailors take pleasure in recognizing the good services rendered them by the electric light. The advantages of the system have been highly appreciated: the increase of the range of the light is very apparent; and, above all, in slightly foggy weather, many ships can continue their voyage, and enter the port at night, which they could not do when oil was used. The light, which at first was rather unsteady, gradually acquired a remarkable fixity, — thanks to the improvement of the apparatus and to the experience gained by the keepers. The fears which were at first entertained regarding the delicacy of certain parts of the apparatus are not realized in practice. The accidents have been rare, the extinctions short and very few, — two only during this period of six years having had a notable duration: one, of an hour, was due to an accident to the steam-engine; the other, of four hours, should, it appears, be attributed to malevolence. Under these circumstances it seems hardly worth while to worry about possible accidents."

Since 1863 experience has only confirmed the favorable views of M. Quinette. The lighthouses of Gris-Nez, France; Cape Lizard, England; Odessa, Russia; and Port Said, Egypt, — have been provided with electric apparatus; and there is a question of placing it in the lighthouses of Planier and Palmyre, France, and in several lighthouses in other foreign countries.

The following information was furnished by MM. Sautler and Lemonnier: —

"When the light is to be fixed, the optical part of the apparatus is composed of a lenticular drum of proper form, which renders the rays horizontal in the vertical plane while allowing them to diverge in the horizontal plane. The dimensions of this drum vary from a diameter of half a metre for a fourth-order light to one metre in a first-order light. This increase in diameter of the apparatus is sensibly proportional to the increase in diameter of the carbon-pencils between which the voltaic arc is produced, and which determines very nearly the dimensions of the electric light. It follows from this, that the vertical divergence remains the same in the different types of apparatus. When the light is to be revolving, the fixed lens is surrounded by a movable drum formed of straight vertical lenses of which the form varies according to the characteristics desired to be given to the light."

Revolving electric lights have this great advantage over revolving oil-lights: the flashes can be given a duration equal to that of the eclipses. In oil-lights, when the light is concentrated in the form of flashes, there are two ends in view: 1°, to augment the intensity, and consequently the range, of the light; 2°, to create an appearance different from that of a fixed light. The first can only be obtained by giving the flash a duration much shorter than that of the eclipse; or, in other terms, by making the angle of the luminous beam a small part of the angle subtended by the lens. Moreover, this angle depends on the dimensions

of the *foyer*,[1] and it can only be augmented either by increasing this dimension or by changing the focal distance of the lens, thus losing a part of the light, since the divergence is produced not only in the horizontal plane, — the only one in which it is utilized for prolonging the flashes, — but in every direction. With the combination of vertical lenses and a cylindrical drum which serves to produce flashes when electricity is used, the divergence of the beams can, by giving the vertical lenses a proper curvature, be augmented as much as desired in the horizontal plane, and the duration of the eclipses be diminished in proportion, while the range of the smallest electric light used will nevertheless remain much greater than that of the most powerful oil-light.

For example: the luminous intensity of an annular panel of 45° of a first-order revolving light with a six-wick lamp equals 9,847 carcels. This is the greatest intensity obtained with an oil-lamp. The divergence of the beam given by this same panel is 7° 7′, and the duration of the flash is about one-sixth part of the eclipse which precedes and follows it.

By applying the methods of M. Allard to the photometric measurements of electric lights, it is found that the luminous intensity of a fourth-order electric light, with a lens half a metre in diameter, and fed by a small model Gramme machine, equals at least 20,000 carcels; and when concentrated by means of straight movable lenses in beams having a divergence such that the durations of the eclipses and flashes shall be the same, its intensity will be equal to 40,000 carcels: that is to say, that it will be four times more intense than that of the most powerful oil-lamp, and with a much shorter duration of eclipse.

By means of electricity such immense quantities of light are produced, that it is not necessary to take into account more or less beams in order to augment the range; the only object of the movable lenses being to produce characteristic appearances which distinguish clearly each lighthouse from its neighbor. These characteristic appearances, the method for producing them, and the system now adopted in France, will be mentioned farther on.

The different lights which serve for the lighting of French coasts are designed so as to answer the different needs of navigation; and their importance varies in consequence according to the rôle they are called upon to play, of which the most important is that of signalling to navigators their approach to land: and the lights constructed for this end are placed in preference upon more or less advanced headlands: which form, according to the expression of M. L. Reynaud, "the angles of a polygon circumscribing all dangers." These are the lights which should have the greatest luminous power, and which, therefore, constitute *first-order lights*.

Between these extreme points indicating the general contour of the coast, the latter still presents advanced points which should become centres of lights of less importance, and serve to guide the vessels to their harbors. The secondary lights placed on these points are called *second-order lights;* and merit their name, not only by their position, but also on account of the less power given to their optical apparatus. Along the route thus traced for navigation are also found localities which it is important should be pointed out to sailors: these are, for example, sand-banks, sunken rocks, islets, etc. From these arises the necessity of luminous *foyers* of various intensities, and the creation of *third-*, *fourth-*, and *fifth-order*, and of even less powerful, *lights*, such as are placed in harbors on the end of jetties, to show vessels the entrance to the channel.

In addition, among all the lights of different orders, some, placed on an island, are designed to throw their light entirely around them; others, built on an advanced promontory or established on a straight part of the coast, only send their rays on a fraction, more or less great, of the zone which surrounds them; finally, others only have to light a determined point: hence the distinction of lights in *lights of all the horizon*, *of three-fourths the horizon*, *of two-thirds the horizon*, etc.

Until 1863 all the lights of the French coasts were furnished with apparatus for oil; and it was not until this epoch that there was installed, at one of the two lights of la Hève, the first apparatus for lighting by electricity. After a year and a half of experiment, the result having been most satisfactory, it was decided to light in the same way the second light of la Hève; and, about two years later, the electric light was also placed in the light-house at Cape Gris-Nez. Matters remained in this condition until within the last few years; and, while England counted on her coasts six electric lights, the three which we have just mentioned were the only ones in existence in France. Lately, the reconstruction of the light-house of Planier having been

[1] The French word *foyer* means literally a *hearth*, *a place where something is burnt*, and, in the sense used here, *the source of light and heat*, — the *space occupied by the flame of a lamp or by the electric arc*. The word is so useful that I take the liberty of using it in place of an English paraphrase.

judged necessary, it was decided to use the electric light in it; and the same decision was taken regarding the lighthouse of la Palmyre, whose luminous intensity was recognized as insufficient.

But the good results given by the electric light at la Hève and at Cape Gris-Nez called attention to the more general service it could render; and on the 27th January, 1880, after a long study of the question, M. Allard, director of the French lighthouse department, presented to the minister of public works an important report, recommending the general adoption, upon the whole extent of the French coasts, of electric lighting. This report was approved on the 4th December, 1880, by the Conseil général des ponts et chaussées; and the principle of electric lighting has just been adopted for the entire extent of the coast. This decision was so important that it seems proper to mention here the principal points of M. Allard's report, to make known the arguments brought to the support of using the electric light, and the results obtained in various trials, and, finally, to give details of the electric installations of this nature actually in use.

Before mentioning the considerations in favor of changing oil for electricity, we must speak a few words on the range of light-houses. The *range* is the distance to which the light is visible at sea; the *circle* of range has this distance as a radius, and the light as a centre. The range of a light depends not only upon the optical conditions in which the light is placed, but also upon its height above the level of the sea. Thus there is a distinction between the *geographical range* and the *luminous range;* the latter being the one under consideration. It increases with the transparency of the atmosphere, which is very variable, and changes with the locality; thus, on an average, it is much greater on the Mediterranean than on the south-western coasts of France, greater on the latter than on the shores of Brittany, and becomes the least in the British channel. Moreover, the transparency varies according to the seasons; and there are, during the year, a certain number of more or less foggy days, during which the transparency of the air and the range of the light are both diminished. It is impossible, therefore, to fix the range as a certain quantity; and it is necessary to establish a mode of designating the varying range. To do this, observations are made during the year on the variations of the range; the foggiest nights are then omitted, and the minimum range for the remainder of the year represents the range for that portion of the year. If, for example, thirty nights, or one-twelfth of the year, are deducted, and, during the remainder of the year, the smallest range is twelve nautical miles, it is considered that the light under consideration has a range of twelve miles for eleven-twelfths of the year. In short, the range of a light during a portion of a year is the distance at which it is always visible during that portion.

In order that the lighting of coasts be efficient, it should be continuous, so that a vessel sailing along the coast, as soon as it passes the range of one light, should come within that of the next; in other words, that the *circles* of range should cut each other successively. With the system of oil-lights now in use, this is actually the case, but only during half the year: during the other half, the oil-lamps have not sufficient power. It will be very different when the electric light is used. The ranges will be increased, and the circles of ranges will cut each other during eleven-twelfths of the year.

The accompanying outline map, Fig. 1, shows what would be the ranges if the electric lights were used, supposing that each light had a mean intensity of 125,000 carcels. The dotted lines show the present ranges with oil-lamps. When the electric light is adopted, the range of the new lights will be 27.7 nautical miles in the Mediterranean for $\frac{14}{15}$ of the year, 19 to 21 miles in the British channel for $\frac{10}{12}$ of the year, and 22 to 26.5 miles on the Atlantic coast for the same period.

If the increase in the range, by using the electric light, is a powerful consideration in favor of this system, objections may, however, be made on the score of economy. The report of M. Allard shows that the expense of executing the entire programme, even including the installations of steam-sirens, will not exceed $1,600,000; which is very reasonable compared with the results obtained. Besides, the cost of maintenance of electric lights is not, as one might have supposed, much greater than that for oil-lights. Thus the annual expense of a first-order oil-light is about $1,660 per year; while for each electric light-house at la Hève the cost is $2,270, and for that of Cape Gris-Nez $2,680. If it is desired to compare the cost of a unit of light for a lighthouse lit by oil with one lit by electricity, it is found that the former costs $81 per unit, while the latter is $22 at Cape Gris-Nez, and $19.40 at la Hève.

It should be said here, that there is only

taken account of, in the above figures, the light of the *foyer* itself, independently of the optical apparatus; which, by concentrating the rays, augments the intensity very considerably.

The number of electric lights comprised in the project is forty-six, counting as two the double lights of la Hève, of la Canche, and other; and, where there is a gap, it will be filled with an oil-light. This map also gives the distinctive characteristics of the different lights, and this is a most important point to be considered.

In a good system of coast-lights, the neighboring lights should have very distinctive

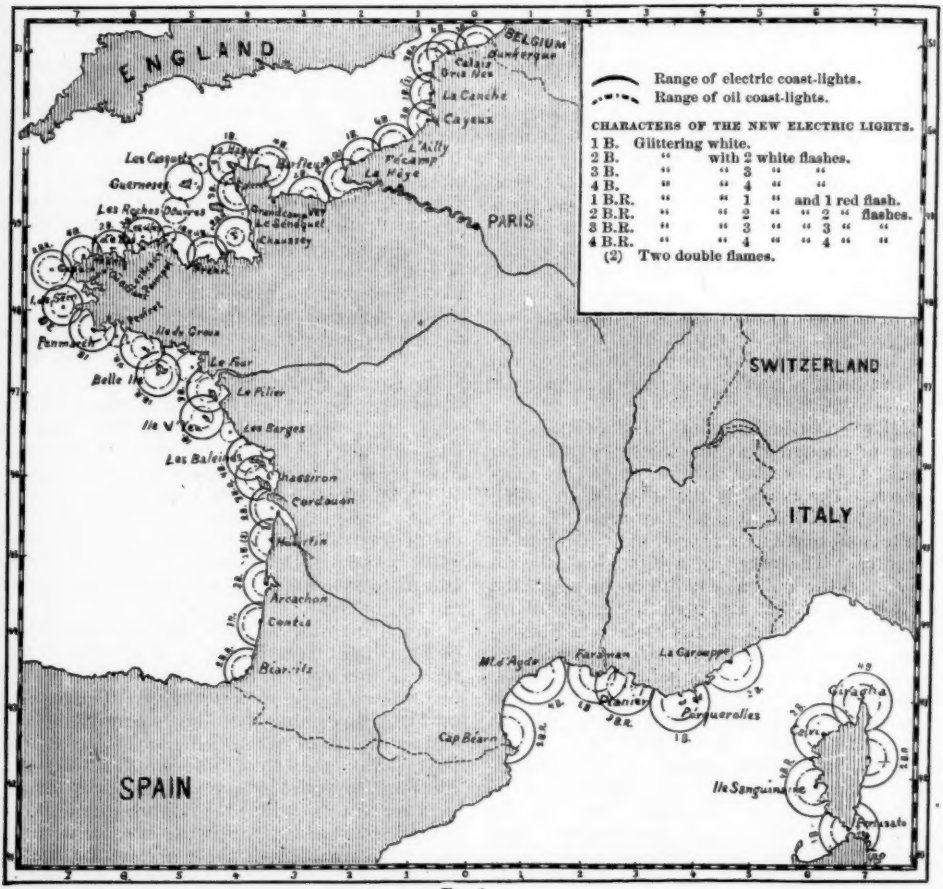


Fig. 1.

of Hourtin. Of this number there are thirty-eight of the first order, two of the second order, five of the third order, and a new one to be placed at the south of Paimpol. Four of these lights are already, or are about to be, lighted electrically.

As to the distribution of the lights, it is easy to follow it upon the map, Fig. 1: almost everywhere the circles of ranges cut each characteristics, in order to avoid all possible confusion. In the existing system, these conditions obtain; and the first idea which naturally presented itself was to retain the old characteristics, simply substituting the electric for the oil light, so that there would be no change from that to which sailors were accustomed: but the existing characteristics are, in some ways, inconvenient, and it has been de-

cided to replace them by others; which, by making the lights more easy to be distinguished, will, besides, increase the range.

The present characteristics are as follows: —

1. A single fixed light.
2. A double fixed light.
3. An eclipsed light, with flashes every half-minute.
4. An eclipsed light, with flashes every minute.
5. A fixed light varied by flashes every four minutes.
6. A fixed light varied by red flashes every four minutes.
7. A light with alternate red and white flashes.

Fixed lights are obtained with a Fresnel apparatus with cylindrical lenses; the double fixed light, by two lights situated at such a distance that they can easily be distinguished from each other, but still appear to form a pair. Fixed lights will eventually disappear, because they have a less range than flashing lights, and also are liable to be confounded with other fixed lights not belonging to a system of coast-lighting.

Flashing lights are obtained by means of optical apparatus having generally eight faces: each face comprises, first, a lens of the same width as the face, then, above and below, portions of rings having as a common centre the centre of the lens. The apparatus thus gives rise to eight beams of light, separated by dark intervals; and, when it is turned, the navigator sees alternately a flash and an eclipse. The intervals between the flashes depend upon the rapidity of rotation. This light has the inconvenience of requiring sustained attention, and of consulting a timepiece to tell the length of the interval. It should be suppressed.

The fixed lights varied by flashes are obtained by means of an apparatus for a fixed light around which turn two or three vertical lenses which give flashes, either white or red, or alternately white or red, at intervals of some minutes. These slowly revolving lights have the same fault as the preceding, and will also eventually disappear.

The characteristic which will be generally adopted is that of a *scintillating* light. To produce it, a fixed-light apparatus is employed, around which revolves a drum of lenses, placed vertically, composed of straight glass bars of lenticular cross-section; each of these concentrates the horizontal rays, and consequently produces a flash. During a rotation, if all the lenses are alike, the navigator will see a series of equal white flashes, producing a scintillating light. If the vertical lenses are alternately red and white, there will be alternately a red and white flash, and a compound red-and-white scintillating light will result. In the same way, by placing the lenses in groups, there can be two, three, four, or more white flashes, followed by a red one. It should be remarked, that, in this case, as the red color diminishes the luminous intensity, the red lens should have larger dimensions to compensate for this loss: as this causes a loss of light, M. Allard prefers, in most cases, to separate the group of white flashes simply by an obscure interval. This is obtained by a simple modification in the form of the vertical lenses. There are thus the following eight characteristics: —

1. White scintillating light.
2. Light with alternate red and white flashes.
3. Light with two white flashes and one red successively.
4. Light with three white flashes and one red successively.
5. Light with four white flashes and one red successively.
6. Light with two white flashes, with intervals of obscurity.
7. Light with three white flashes, with intervals of obscurity.
8. Light with four white flashes, with intervals of obscurity.

These are the only characteristics which have been definitely adopted. They have the advantage of being readily recognized without consulting a timepiece.

LETTERS TO THE EDITOR.

The new comet in Pegasus.

I DESIRE to give publicity to the following statement regarding the priority of discovery of the new comet in Pegasus. I discovered it at seven o'clock last evening; and, as soon as the direction and rate of motion was ascertained, I repaired to the telegraph-office (a mile away), and telegraphed its discovery to several astronomers, and to Professor Pickering to cable to Europe. In journeying thither I must have passed the messenger-boy with a telegram from Mr. W. R. Brooks of Phelps, N.Y., which I found at the observatory on my return, announcing to me his discovery of the same object.

It was then too late to undo the mischief I had innocently done. In fact, I was not even then sure that there was any guilt attaching to the transaction, as he did not give the time of discovery. He immediately wrote, however, giving the time as forty-five minutes past six, local time, which letter reached me to-day.

I consider it my duty to give to the world the above facts, that no injustice be done to Mr. Brooks. No instance occurs to me of a comet having been discovered by two persons so nearly simultaneously.

The comet is quite bright, with a strong central condensation, though no nucleus could be detected. Its tail was about 40′ in length, faint, straight, and narrow.

The shutter of the dome of the observatory is undergoing some slight repairs, which prevented the use of the 16-inch refractor; and I was, in conse-

quence, unable to obtain its position except by estimation.

At twenty minutes past seven I estimated it to have been in about R. A. 22 h. 57 m., Dec. + 29° 50′, as determined by comparison with Argelander's charts, no allowance for precession being made. It was 2° 37′ almost exactly north of Beta Pegasi, as roughly determined by the size of the field of my comet eye-piece. Its motion is slowly eastward, probably north-east; but its altitude was so low, and the hour being so near moonrise, I could not determine its exact direction.

It presented a beautiful appearance through my 4½-inch achromatic. LEWIS SWIFT.

Warner observatory, Rochester, Feb. 24.

Movement of the arms in walking.

In SCIENCE, Feb. 9, Mr. F. W. True recognizes the 'movement of the arms in walking' as a functional relic of quadrupedal locomotion; urging thereby a modification of the expression of Professor Dana, sanctioned by Dr. Gill, that "man stands alone among mammals in having the fore-limbs not only prehensile, but out of the inferior series, the posterior pair being the *sole* locomotive organs." And the questions are asked, "Have we not at least a ghost of a pre-existing function? Does man walk by means of his feet and legs alone?" Viewing the question from the developmental standpoint, it seems to me that the strongest evidence appears in the first locomotor-acts of the child. Before bipedal progression is learned, *the child goes on all-fours, and is an actual mammalian quadruped.* At the beginning of this the prehensile power of the fingers is very imperfect. Men have been known to educate their toes to do more than the fingers can at that stage of functional development. At that time the palms are of more value as soles than for holding things. In the beginning, also, the arms in some children are better legs than are the hind-limbs, being more easily used. For example, it is more common for children to creep on the knees than on the elbows; but some learn remarkably early to elevate both knees and elbows, to creep on the soles and palms. My own boy walked on his soles and palms from the start, and never upon his knees. The speed with which he finally learned to run in this way was remarkable. After learning to move somewhat on his hind-legs, when he got in such haste as to make bipedal balancement difficult or uncertain, he would take to all-fours, thereby making better speed with less danger of a fall.

U.S. dept. of agric., Washington, Feb. 13, 1883. W. S. BARNARD.

The heart as a locomotive organ.

Every one has observed that the tendency of the heart to beat while walking 'is a most natural one.' 'The action is rhythmical,' the number and force of the pulsations varying with the velocity of the walk. 'It is also involuntary;' but, although proper locomotive movements are usually in a high degree *voluntary*, this consideration need cause us no uneasiness, if we reflect, that, when its action is from any cause suspended, 'an air of stiffness' is soon imparted to the whole body.

In view of these facts, does it not seem that the statement (SCIENCE, p. 11) that "man stands alone among mammals in having the fore-limbs not only prehensile, but out of the inferior series, the posterior pair being the *sole locomotive organs*," should be further modified, and the heart assigned its proper place between the swinging arms as a *true* locomotive organ? O. HARGER.

New Haven, Feb. 28.

The copper-bearing rocks of Lake Superior

There are one or two statements in Mr. Selwyn's remarks on the age of the rocks on the northern shore of Lake Superior, in the number of your journal for Feb. 9, which I cannot suffer to pass unchallenged.

I cannot enter here into a general discussion of the much-vexed question of the age of the Lake Superior copper rocks, — I have discussed it at length elsewhere,[1] — but I must take issue with the statement that there is "no evidence whatever of their holding any other place in the geological series" than that which "includes the Potsdam and Primordial Silurian." My own conclusions in this connection, after an examination of most of the circuit of Lake Superior, are: —

1°. That the copper-bearing rocks underlie unconformably — and with an immense unconformity — a series of sandstones holding Cambrian fossils. These fossils may not correspond to the oldest Cambrian fossils known elsewhere, as argued by N. H. Winchell in the report quoted, but they are distinctly Cambrian; and if the copper-bearing strata are to be called Cambrian, then we must stretch that term over a most immense unconformity, in order to include a rock-series holding no fossil evidence of its Cambrian age, — a thing which appears to me very unreasonable to do. This unconformity is best seen in the St. Croix river region of western Wisconsin, and thence north-eastward. Although attention was drawn some years since by Sweet, Chamberlin, and myself,[2] to the strikingly conclusive occurrences of this region, our evidence has been ignored by others who have never examined the region, and who continue to approach the question from the eastward, or, in other words, from the same direction as a succession of geologists, from Houghton to Selwyn, all of whom have felt baffled. It is interesting to note in this connection that N. H. Winchell, the only geologist who has gone to the St. Croix since our report was issued, confesses to the unconformity,[3] although he had strenuously refused to believe in it before visiting the region. It does not seem to me that any geologist can honestly deny this unconformity until he has done as we have done; viz., followed the copper-bearing strata, with all their characters preserved, mile by mile, from the typical region of Keweenaw Point, to their junction with the fossiliferous Cambrian sandstone of the St. Croix valley.

2°. That the copper-bearing strata also underlie unconformably the 'eastern sandstone' of the south shore of the eastern half of Lake Superior. Winchell has argued a difference of age between this sandstone and that of the St. Croix valley. However this may be, — and I have myself seen no evidence that the one of these sandstones is not merely the direct downward continuation of the other, — the work done by myself and assistants along the contact line of the copper-bearing rocks, and the eastern sandstone from Bête Grise Bay westward to the vicinity of Lake Agogebic, has served to convince me that there is here also an unconformity as great as the other.

3°. That the time-gap between the copper-bearing series and the Huronian was too long to allow of our classing them together, — for it certainly covered a considerable amount of denudation and alteration, — but it is still doubtful if this gap was long enough to cover the folding of the folded Huronian. The greatest confusion prevails as to the use of the term Hu-

[1] The copper-bearing rocks of Lake Superior, — vol. v., monographic publications of the U. S. geol. survey; also Third annual report of the same survey. Both of these publications are still under press.

[2] Geology of Wisconsin, vol. iii. [3] Loc. cit., p. 134.

ronian. The Canadian geologists have fallen into the custom of calling every thing Huronian that is schistose, and yet it is evident that much of the schists called by them Huronian are but dependencies of the older gneiss. I may say in this connection, that the 'Animikie group' of Thunder Bay, which Selwyn, following Logan, refers to the copper-bearing series, is, beyond question, the exact equivalent of the unfolded iron-bearing rocks of the Penokee region of Wisconsin, and these again of the folded iron-bearing schists of the Marquette and Menominee regions; and that there can be little doubt that all of these are the equivalents of the original Huronian of the north shore of Lake Huron. This reference of the Animikie rocks to the Huronian is, I know, a novel position, although Logan long since for a time held the same view; but I feel confident that it is a correct one. Indeed, I speak confidently as to all of the conclusions here mentioned, because I have had unusual opportunities for observation, having studied both the Cambrian sandstones and the copper-bearing rocks, as well as the Huronian from Keweenaw Point across Wisconsin, into Minnesota, and thence north-eastward to Thunder, Black, and Nipigon Bays. Having made this wide sweep, I can see quite well how others, examining only portions of the district, should be puzzled or reach different conclusions.

There is one other statement in Mr. Selwyn's letter that I cannot concur in; and that is as to the occurrence of tuffs, or volcanic detrital matter, among the copper-bearing rocks. I know such materials should be expected to occur in a series largely composed of volcanic flows; but after a careful search for them in the field, and the study of a large number of thin sections, I can find no fragmental rocks which are not either certainly ordinary sediments or at least much more probably so than of direct volcanic origin.

Madison, Wis., Feb. 16, 1883. R. D. IRVING.

WHITNEY'S CLIMATIC CHANGES.

The climatic changes of later geological times: a discussion based on observations made in the Cordilleras of North America. By J. D. WHITNEY. Cambridge, 1882. 14+394 p. 4°.

I.

THIS volume is one of a series, by the same author, based on the work of the California geological survey, but published under the auspices of the Museum of comparative zoölogy. The preceding volume treated of the auriferous gravels of California, and this one is in some sense a sequel to it. Although the treatise is an outgrowth of the Californian work, its material includes observations by the author in eastern America and in Europe, as well as data gathered by others from all regions. It is of interest, not only by reason of its contribution of original matter, but because it develops at length a theory that has heretofore been stated but briefly, and which has been almost ignored by the advocates of its rivals. The book comprises four hundred quarto pages, but is without index, — an omission only imperfectly supplied by an analytic table of contents.

In the volume on the Auriferous gravels, our author states that the Sierra Nevada has had substantially the same height and dimensions from cretaceous time. The streams which flowed down its western flank during the tertiary did not excavate gorges, but, on the contrary, spread great bodies of detritus. The modern rivers, following essentially the same courses, have cut deep V-shaped cañons, which were partially filled with ice during the glacial epoch. The tertiary climate was relatively moist, as is shown by the broad channels of the tertiary rivers, and by the fact that they filled their valleys with gravel instead of cutting cañons.

In the present volume, the idea of a diminution of precipitation from pliocene to present time is expanded into a theory of general, continuous, secular desiccation, and is developed at length. Evidence is adduced to show, that within historic time there has been a shrinking of lakes and rivers in South America, in the interior basin of Asia, and about the shores of the Mediterranean; and that, in late geological time, large areas in northeastern and northwestern Asia and northern Africa were covered with water, while the Great Basin of North America contained a system of fresh-water lakes. The ancient glaciers of the Sierra Nevada, and of the Cordilleras generally, are described; and their disappearance is referred to the same desiccation. An account is given of the tertiary lakes of western North America, and it is pointed out that their extent gradually diminished. The popular theory that modern desiccation is due to the destruction of forests, and the theory of some geologists that the great lakes and rivers of the immediate past were connected with the melting of the ice of the glacial epoch, are controverted; and it is argued that all the phenomena pertain to a general, secular diminution of precipitation.

To account for this diminution, the following considerations are adduced: The amount of moisture precipitated to the earth depends on evaporation. The amount of evaporation depends on temperature and on the extent of water-surface. If, therefore, it can be shown that the continents of the earth have gradually increased in area, while the oceans have gradually diminished, or if it can be shown that the temperature of the atmosphere has gradually lowered, then an explanation will be afforded of the change in precipitation. After a review of the facts, Professor Whitney concludes that an expansion of continents has actually taken place, but that it is inadequate to account for the observed recent desiccation. He therefore bases his theory chiefly upon a loss of heat,

adopting the doctrine of the dissipation of solar energy, and citing the paleontologic evidence of warm tertiary climates in arctic regions.

Search is made for proofs of recent changes of temperature corresponding to the recent changes in precipitation. The thermometric record is rejected, because the conditions of observation have not been constant; but certain circumstantial evidence is admitted. The northern limit of the grape and other cultivated plants is observed to be now farther south than formerly, and the northern limit of human habitation has been crowded somewhat southward. The people of Greenland and Iceland are emigrating, and icebergs are multiplying in arctic waters.

This theory of the continuous fall of general temperature is evidently inconsistent with the prevalent assumption that the glacial epoch was a period of exceptional cold, and a considerable share of the book is devoted to the setting-aside of that assumption. To this end the present glaciation of the earth is reviewed at some length, and the conditions of glacier formation are discussed. It is shown that mere cold, whether it pertain to high latitude or to high altitude, is not sufficient, but that an abundant precipitation must accompany it; and, since a lowering of general temperature tends to check precipitation by checking evaporation, it should not be predicated as the cause of the glacial epoch. A higher general temperature is quite as likely to be a favorable condition for producing the demonstrated effects.

For a series of decades there has been a general shortening of the glaciers of the Alps, the Caucasus, and the Pyrenees. In some localities the retrograde movement began about fifty years ago; in others, twenty-five; and the longer glaciers have receded several thousand feet. This is ascribed to a slight diminution of precipitation, caused by the general cooling of the atmosphere, and is correlated with the desiccation of the shores of the Mediterranean.

The phenomena of the glacial epoch are then reviewed; and it is stated that only in western Europe and north-eastern America was the glaciation so extensive as to demand the assumption of conditions considerably different from the present. The environments of individual glacier districts are discussed, and the prevalent ideas with reference to the magnitude of the phenomena of the glacial epoch are combated.

In particular are the phenomena of Greenland, Scandinavia, and the Ural contrasted. Precipitation is now small in the district of the Ural, large in Scandinavia, and probably large in Greenland. This accounts for the extensive glaciation of Scandinavia and Greenland, and the absence of glaciers, both ancient and modern, from the Ural. The present conditions of Scandinavia and Greenland differ chiefly in that the latter is somewhat higher and more maritime; and to account for the ancient extreme glaciation of Scandinavia, it would be natural to suppose that it then resembled Greenland in these respects. According to the Swedish geologists, this was the case. Its altitude was greater, and during at least a portion of the glacial epoch the plain at its eastern margin was submerged.

The description of the glaciation of north-eastern America is somewhat meagre, and is chiefly characterized by a tendency to estimate lower than other geologists the magnitude of the phenomena. The existence of an ice-sheet is not denied; but the difficulties attending the glacial hypothesis are emphasized, and great importance is attached to the work of icebergs and rivers.

Incidentally the book is replete with illustrations of the independence of the author's opinions. He ascribes no erosive power whatever to glaciers, but refers the multitudinous rock basins of Canada and Finland to chemical decomposition and orographic displacement, and asserts that the tendency of streams is to deepen these basins rather than obliterate them. He has a theory of glacier-motion in which water plays an important part; and he ridicules the idea that different layers of a confluent ice-mass can move in different directions. The statement that most, if not all, of the detrital material of north-eastern North America is destitute of any true morainic character, will sound strange to the geologists who are now studying the moraines of that region.

In a succeeding number some of the author's more comprehensive conclusions will be discussed.

THE GOVERNMENT AGRICULTURAL REPORT.

Report of the commissioner of agriculture for the years 1881 and 1882. Washington, *Government printing-office.* 1882. 704 p., 84 pl. 8°.

Inasmuch as the present commissioner, when he entered upon his duties, "found the work for the season, both regular and special, elaborately laid out by my [his] successor," his report not unnaturally bears a strong resemblance to the reports of preceding years. It

contains the usual reports of the entomologist, the superintendent of grounds, the botanist, the chemist, and the statistician, besides special reports relating to the diseases of animals and to the boring of artesian wells on the arid lands of the west. The tone and matter of the special reports and of the reports of special character compare so favorably with most of those of the old-style 'regulars,' that the thought suggests itself, that a much larger proportion of the work of the department than has hitherto been customary could best be done by special commissioners outside of Washington and far away from its influences. From the very nature of the situation and surroundings of the Department of agriculture; the irregularity of its income; and its dependence for support upon the favor of political parties, — let alone the merciful dispensation that the tenure of office of its chief is short, — it cannot be accounted competent to carry on continuous scientific researches; and it is in no sense desirable that it should do so. Works of *longue haleine* such as must necessarily run on consecutively from year to year are beyond its powers; and it will be well for Commissioners of agriculture, present and future, to accept the fact. Rather than try to grasp the unattainable, it will assuredly be wiser to study special finite questions as they present themselves; and to this end the best means is the employment of special scientific men of approved competency, each one to grapple with his own particular question in such place and manner as he may deem fit.

One commendable feature of the present volume is the comparative brevity of the reports of the superintendent of grounds and the botanist (of the report of the entomologist we shall speak at another time). The report of the chemist, on the other hand, is extended, and it has somewhat the effect of a twice-told tale. It was interesting and important to prove that the proportion of true sugar in sorghum-stalks increases continually until the plant is well advanced toward maturity; but the evidence of this fact presented in previous reports seemed convincing, and many of the results recorded in the present volume have the effect of being little more than refinements upon good work. The reader is inclined to ask whether it is not about time for the department to let its scientific corps drop sorghum, and to relegate the subject to the artsmen proper; that is to say, to those farmers and manufacturers who are specially interested in this line of business.

From a letter of the 'commissioners for locating artesian wells upon arid and waste lands,' as well as from the statements of the commissioner of agriculture himself, it appears that in their opinion the first trial-well at Fort Lyon in Colorado was not a success. The onus of this 'failure' is made to rest, of course, on the shoulders of a preceding administration; but the lesson it teaches is none the less instructive. It suggests the reflection, that while one important function of the Department of agriculture has been to show the American people 'how not to do it,' there are various ways in which the lesson is enforced. Impracticable borings in Colorado undoubtedly represent one mode of tuition, but in the appointing and changing of employés for political reasons we have another; and to the same end must inevitably work all changes of base which are hasty, spasmodic, and inconsequent. It will be of interest to notice how far down the next borings will be permitted to reach before a new incumbent says, 'Hold, enough!'

From a couple of modestly printed tables on pp. 25 and 692, it appears that the Department of agriculture disbursed $256,129.68 during the year ending June 30, 1881, and $353,748.60 during the year ending June 30, 1882. It will convey no new information, either to scientific men or to the agricultural community, when we say that the results obtained by this class of expenditures have hitherto been, out of all proportion, small.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

The polar quadrilateral. — As a geometrical interpretation of a property of the roots of an equation of the fifth degree, A. Brill shows that the six points in which a conic circumscribing a triangle can be made to osculate a fixed conic are the same for certain five triangles connected with a polar quadrilateral of the fixed conic. — (*Math. ann.*, XX. 331.) C. L. F. [288

Ruled spaces. — In a thesis presented to the Sorbonne, M. Koenigs studies the infinitesimal properties of an extensive class of linear complexes, basing his researches upon the earlier investigations of Plücker, Kummer, etc. M. Koenigs observes, that in punctual space, tangential space, and in space of which the sphere is an element, every infinitesimal property is expressed as a property of involution. He commences by defining certain primordial elements which he regards as necessary and sufficient for the expression of all mutual relations of the infinitesimal prop-

erties of ruled spaces. He defines a point a, and a plane a through this point, as a *couple*, which he indicates by the symbol (a, a). Among the ∞^2 couples situated upon a straight line A (i.e., the point a lies on a straight line A, which is itself contained in the plane a), there is a simple infinity satisfying a given condition; their aggregate constitutes a *correlation*. If this condition consists in the equality of the anharmonic ratios of the four points and the four planes of four arbitrary couples of the correlation, the correlation is said to be *anharmonic*. An important application is made of a theorem of Chasles', concerning the distribution of the tangent planes to ruled surfaces. If $u_1\ u_2\ u_3\ u_4$ are parameters upon which depend a knowledge of a right line (u), and $u_1 + du_1$, etc., those which refer to an infinitely near line $(u + du)$, the vanishing of a homogeneous function of the differentials du expresses a property of the system of lines (u) and $(u + du)$, and, consequently, of the correlation which they determine relatively to one of the group (u). The differentials du, or finite quantities t proportional to them, may be considered as homogeneous co-ordinates of the different anharmonic correlations existing upon the line u. Among these correlations those which destroy one or two kinds of t-co-ordinates constitute, respectively, a *plexus* or a *series* of correlations. These plexi and series replace the cones of elementary directions in punctual space. The condition for the meeting of two lines (u) and $(u + du)$ is expressed by the vanishing of a quadratic form $N(du)$; and, obviously, all forms such as $KN(du)$, where K is only a function of the variables u, express the same property. The author remarks that it is possible to choose K in such a manner that the resulting form shall represent the moment of the two lines: i.e., the product of the shortest distance between them by the sine of the angle of their mutual inclination. A number of analogies are here given with punctual spaces. The author makes use of a theorem of Sturm's, concerning pencils of lines; and, particularly, of a method of Darboux', referring to the linear representation of surfaces. A special system of co-ordinates is examined, in which the linear complex possess the properties of spheres; and from this is deduced a system analogous to pento-spherical co-ordinates, of which the Plückerian co-ordinates and Klein's sextuply-orthogonal system are particular cases.

The third part of the memoir refers entirely to infinitesimal properties of the second order. The problem treated is an extension of the theory of geodesics, and conducts to a geometrical interpretation of Lipschitz' *normal co-ordinates*. — (*Bull. sc. math., etc.*, 1882.) T. C. [289

PHYSICS.

(*Photography.*)

Photographic halos and reversals. — When a brilliant point of light is photographed, we often find that it is surrounded by a black circle on the negative, whose inner edge is distinctly marked, while its outer shades off imperceptibly into the surrounding regions. Capt. Abney shows that this is not a diffraction phenomenon as has been asserted, but is due to reflection from the back surface of the glass; and that the diameter of the ring depends on the thickness of the glass, and on its critical angle of reflection. All trouble from halos may be avoided by coating the back of the plate with Brunswick black, which reflects back no light to the film.

It is a well-known fact, that, if we greatly over-expose a plate, we shall get a reversal of the image, — the lights taking white, and the shades black, instead of *vice versa* as usual. Now, it has been shown that this is due to the action of the bromine, which has been freed in the lower layers of the film by the action of light, and rises, attacking the metallic silver and sub-bromide in the upper layers. This difficulty is avoided by soaking the film in a solution of potassium nitrite, which absorbs the bromine as fast as it is formed, and before it can do any damage. — (*Brit. journ. phot.*, Jan. 5.) W. H. P. [290

Keeping-qualities of gelatine plates. — Mr. William Brooks has been making some experiments on the keeping-qualities of gelatine plates, and finds, that, though they may work well for a few months, they become slower after that time, the images thinner, and that they develop a tendency to fog. Emulsions were made up with the different silver salts: and it was found that plates coated with the pure bromide of silver would keep well for six months; those coated with bromo-iodide would keep four months; those with bromo-chloro-iodide, three months; and bromo-chloride, two months. The latter plates gave by far the best results when new; but unexposed plates very soon deteriorated, especially if the weather was damp. — (*Brit. journ. phot.*, Feb. 2, 1883.) W. H. P. [291

Lead as an intensifier. — Herr Grebner recommends the following intensifying solution: nitrate of lead, 4 parts; potassium ferricyanide, 6 parts; water, 100 parts. When this solution has acted sufficiently long upon the plate, it is taken out and washed; it is then placed in a mixture of one part of a saturated solution of potassium chromate, and five parts of ammonia, after which it is washed for a short time. If washed too long, the film has a tendency to peel. This formula is applicable to collodion plates. — (*Brit. journ. phot.*, Feb. 2, 1883.) W. H. P. [292

Electricity.

Determination of the ohm. — G. Lippman proposes to measure the resistance of a column of mercury by opposing the current induced by a rotating magnet to another current measured by a galvanometer. Then

$$r = \frac{2\pi n m \mathrm{K}}{\mathrm{K'H}\tan a};$$

where K is a constant of the electro-magnetic apparatus, m the moment of the magnet, n its velocity of rotation, K′ the galvanometer constant, and H the horizontal resultant of local magnetic forces. $\frac{m}{\mathrm{H}}$ is determined by Gauss's method. The author claims, that in a resistance of one to five ohms the fractional error would be within $\frac{1}{1000}$. — (*Comptes rendus*, xcv. 23.)

Another method, by the same author, is to revolve a coil inside of a bobbin which carries a current passing through the resistance to be measured. The current induced in the revolving coil is opposed to the difference of potential at two points in the resistance to be measured. The condition of equilibrium is $r = 2\pi n \mathrm{C\,S}$, where n is the velocity of rotation, S the distance between the points of contact, and C a constant of the bobbin. The author gives an experimental method of finding S′, the value which S would assume if the bobbin were extended to infinity in both directions. The value of C for such a bobbin is $4\frac{\pi}{d}$, d being the distance between two turns of the wire. — (*Comptes rendus*, xcv. 26.) J. T. [293

Aërial navigation by electricity. — M. Gaston Tissandier has found that an electric motor of the Siemens pattern, driven by a bichromate battery, the whole not exceeding the weight of three men, is

capable of furnishing regularly for three consecutive hours the work of twelve to fifteen men. A balloon of 900 cub. m. capacity could raise in the air such an apparatus with the additional load of two or three men. M. Tissandier is now engaged in the construction of a gas-generator; after this is completed, he hopes to construct an elongated balloon to which he can apply his machinery. — (*Rev. électr*, Jan. 27, 1883.) J. T. [294

Cost of electric lighting. — Dr. Siemens, in his address to the London society of arts, showed that arc-lamps were cheaper than incandescent lamps, and that both would be decidedly cheaper than gas-lighting if the electric companies had the opportunity to make sufficiently large plants, and the gas companies continued to pay their present large dividends. — (*Rev. électr.*, Nov. 25, 1882.) J. T. [295

New electric lamp. — Mr. Charles Lever of Manchester has invented and patented an electric lamp in which the carbons are held apart by a spring when no current is passing. The current, when first started, excites an electro-magnet which releases a clip, and allows the upper carbon to fall upon the lower; the weakening of the magnets consequent on shunting the current through the carbons allows the spring to bind the clip, and draw back the upper carbon to the proper distance. When the carbons burn away so as to increase the resistance greatly, this process is repeated. — (*Rev. électr.*, Jan. 6, 1883.) J. T. [296

Electric torpedo-boat. — A torpedo-boat has just been satisfactorily tried at Constantinople, in which a Siemens electro-motor drives two screw propellers in the rear of the boat. The vessel is cigar-shaped, and moves under water at the rate of eight knots an hour. Its path is traced in the day-time by a wire which projects above the surface, and is followed by a telescope; in the night, by a lantern having an opening only towards the shore, and a light too feeble to betray itself to the enemy by reflection. The place in which the torpedo-boat was tried furnished a severe test on account of the strong currents, which vary in direction in different parts of the channel, and in strength from one part of the day to another. The wires conveying the explosive discharge are, of course, distinct from those carrying the motive current. — (*L'Électricité*, Jan. 6, 1883.) J. T. [297

Electro-magnetic theory of light. — J. W. Gibbs continues his mathematical treatment, obtaining in this paper as the general equation of monochromatic light in a medium of any degree of transparency: —

$$\frac{4\pi^2}{p^2} Pot\,[U]_{Ave} - \nabla[q]_{Ave} = \Phi[U]_{Ave} + \Psi[\dot{U}]_{Ave},$$

where Φ and Ψ denote linear and vector functions; *Pot*, the operation by which the potential of a mass is derived from its density; q, the actual potential; U the electrical displacement; and p, the period of the luminous disturbance. The symbol $[\,]_{Ave}$ denotes a space-average taken through a sphere of unit radius concentric with the point considered. This treatment removes certain objections to the electro-magnetic theory raised by Lorentz and Rayleigh. The equation, however, is not claimed to be rigorously general. — (*Amer. journ. sc.*, Feb., 1883.) J. T. [298

Planetary induction. — M. Quet considers the magnetic induction of the planets on the earth, and obtains

$$\frac{F}{F_1} = \frac{R^3 V N p}{R_1^3 V_1 N_1 p_1} \sqrt{\frac{\cos^2 u - 3h^2h'^2 - 2h\,h'\cos u + 4h^2}{\cos^2 u_1 - 3h_1^2h'^2 - 2h_1 h_1'\cos u_1 + 4h_1^2}};$$

where F and F_1 represent the forces which Jupiter and the sun, for instance, exert on the earth, V the volume, N the angular velocity, p the magnetic power, u the angle of the magnetic axis with the axis of rotation, h and h' the cosines of the angles which these two axes make with the radius vector from the earth's centre. — (*Comptes rendus*, xcv. 23.) J. T. [299

Distortion of the spark by statical electricity. — M. Aug. Righi argues, that the spark of a disruptive discharge ought to be acted upon by neighboring statical charges, as if the spark were a body electrified to the same sign as the electrode whose electric density before discharge is stronger. Experiments in which one electrode of a Holtz machine is connected with the earth, and also where one electrode has a greater curvature than the other, confirm his conclusions. — (*Comptes rendus*, xcv. 24.) J. T. [300

ENGINEERING.

Regulation of rivers, and prevention of floods. — A valuable report upon the rectification of the Rhine and Danube has been made by M. Gustave Wex, privy councillor to the emperor of Austria, in which an account is given of the work carried on between Mannheim and Basle during the period from 1819 to 1863, by which the distance has been shortened from 252 to 169 kilometers, and the fall increased by thirty per cent. The stream has moreover been confined to a uniform channel, the banks being carefully protected, and the old bed with its branches filled, and the land thus reclaimed brought under cultivation. Government considers that the benefits from the change are so large as to make ample payment for the outlay. Similar work upon the Danube has been in progress from 1869 to 1881. The author concludes, that from 48 years of observation and experience of extensive works undertaken for the improvement of rivers, it can be confidently stated that by careful study, even the most tortuous rivers and the swampiest valleys can within a few years yield the most satisfactory results. — (*Van Nostrand's eng. mag.*, Feb., 1883.) G. L. V. [301

The preservation of timber. — A committee of eight members of the Amer. soc. of civil engineers has made a preliminary report upon the above matter, in which a list of thirty-three different chemical processes is presented for preserving wood from decay. The census of 1880 has shown the need of a far more economical use of timber in this country than has prevailed heretofore. Not less than a thousand circulars were sent out to civil engineers, railroad-superintendents, dealers in timber, and chemists; and numerous letters from engineers are given, in regard to the duration of wood under various conditions. — (*Trans. Amer. soc. civ. eng.*, Oct., 1882.) G. L. V. [302

New harbor at Vera Cruz, Mexico. — The plans of Mr. James B. Eads for a new and extensive artificial harbor at Vera Cruz have been for some time before the engineering world, and the work was commenced last autumn. The natural harbor is exposed to gales from the north and north-west, and is often made very dangerous during storms. The plan of Capt. Eads provides for a quiet harbor with deep water and suitable lights for guidance of shipping. The cost of the above works is reckoned at about ten millions of dollars. — (*Engineering*, Nov., 1882.) G. L. V. [303

CHEMISTRY.

(Organic.)

Dianilido-phosphorus hydrate. — Professor Jackson mentioned a Dianilido-phosphorus hydrate ($C_6H_5NH)POH$, which he and Mr. Menke had obtained by the action of phosphorus trichloride upon aniline. The crude product formed by adding

phosphorus trichloride to aniline was heated over a free flame in a porcelain dish, and the orange-yellow product boiled with alcohol. On adding water a white precipitate of the above composition was thrown down. This substance is not acted upon by aqueous potassium hydrate nor by dilute sulphuric acid, but it is decomposed by strong nitric acid. — (*Harvard chem. club; meeting* Jan. 9.) [304

Phenoxybromacrylic acid. — Professor Hill described phenoxybromacrylic acid which he had obtained by acting upon mucobromic acid with potassium phenolate, and treating with potassium hydrate the product thus obtained. He proposed to study it more carefully with the hope of establishing the relative position of the bromine atoms in mucobromic acid and the connected dibromacrylic and dibrommaleic acids. — (*Ibid; meeting* Jan. 23.) [305

(*Analytical.*)

Quantitative determination of calcium. — Dr. Kinnicutt gave an account of some experiments which he had undertaken with Mr. F. G. Short on the quantitative determination of calcium. Calcium oxalate is precipitated highly crystalline from a boiling solution if it is cooled rapidly, and it may be filtered immediately. In the separation of calcium and magnesium, the calcium oxalate may be filtered without standing, if the formation of an ammonio-magnesium oxalate is prevented by using a small excess of ammonium chloride and by cooling rapidly after precipitation. — (*Ibid.*) [306

Estimation of sulphur in illuminating-gas. — A method proposed by O. Knublauch consists in burning a known volume of the gas, mixed with air, in a glass tube, and absorbing the sulphuric and sulphurous acids in a solution of potassium carbonate. After oxidation of the sulphurous acid with potassium permanganate, the sulphur is calculated from the weight of barium sulphate obtained by precipitation with barium chloride. For details of the method, and description of the apparatus, reference is made to the original article. — (*Zeitschr. anal. chem.*, 1882; also *Berichte deutsch. chem. gesellsch.*, xv. 2403.) C. F. M. [307

Volumetric determination of copper, iron, and antimony by the processes of M. F. Weil. — If a standard solution of stannous chloride is added to a boiling solution of cupric chloride containing sufficient free hydrochloric acid to impart to it a yellow color, complete reduction of the copper solution is indicated by disappearance of the color. A solution of ferric chloride also is rapidly reduced by stannous chloride. In each case the final re-action is so clearly marked that no other indicator is required. When cupric chloride is added to a solution of antimonic chloride in an excess of hydrochloric acid, the mixture acquires a greenish-yellow color. If the quantity of copper is known, by deducting from the volume of tin solution required to reduce the mixture the volume corresponding to the copper, the difference represents the volume of stannous chloride required to reduce the antimonic to antimonious chloride. Copper, iron, and antimony may be determined in the same solution by a combination of these methods. After each series of determinations the tin solution must be restandardized. — (*Revue des mines, Chem. news*, 46, 284.) C. F. M. [308

AGRICULTURE.

Availability of nitrogenous fertilizers. — To obtain an approximate idea of the relative value of different nitrogenous substances as fertilizers, Stutzer and Klinkenberg propose to digest them with an acid solution of pepsin, and determine the proportion of nitrogen soluble in this reagent. They find that a definite proportion of the nitrogen is entirely unacted upon, as Stutzer has previously shown to be the case with fodders; and this portion they consider of little value as a fertilizer. — (*Journ. für landw.*, 30, 363.) H. P. A. [309

Fineness of superphosphates. — In pot experiments with finely ground superphosphate and with the same substance artificially granulated, Wagner finds the former decidedly superior. — (*Biedermann's central-blatt*, 1882, 665.) H. P. A. [310

Clover sickness. — A particular case of 'clover sickness' has been investigated by Kutzleb. It was shown that the failure of the clover was not due to parasites, to lack of nitrogen, to lack of water, or to unfavorable physical properties of the soil. An analysis of the soil showed a decided deficiency of easily soluble potash (soluble in carbonic-acid water), especially in the subsoil, in comparison with the soil of neighboring estates on which clover flourished; and the clover sickness is attributed by the author to this cause. No attempt appears to have been made to test the effect of manuring the field in question with potash. — (*Biedermann's central-blatt*, 1882, 728.) H. P. A. [311

Seed-testing. — Ad. Mayer and Van Pesch suggest various unimportant modifications in the methods of seed-testing in general use in the seed-control stations of Germany. Nobbe comments on these suggestions. A subsequent paper by Nobbe treats of the method to be followed in testing the sprouting power of beet-seed, and of the best manner of expressing the results. — (*Landw. versuchs-stat.*, xxviii. 167, 283.) H. P. A. [312

GEOLOGY.

Induration of rocks by atmospheric action. — Dr. M. E. Wadsworth gave some observations, made in 1871–73, upon the effect of atmospheric action in indurating the friable St. Peters and Potsdam sandstone in Wisconsin. This effect was quite strongly marked upon the exposed surfaces, resulting in induration, the partial obliteration of the granular structure, the formation of concretions, and even of quartz crystals; while the covered portions of the same blocks and slabs retained the usual friable character. — (*Bost. soc. nat. hist.; meeting* Feb. 7.) [313

Glacial phenomena of Mill Rock near New Haven. — Prof. W. P. Blake spoke of the low east-and-west ridge just north of New Haven, and referred its existence to the intrusion of trap-rock in the form of a narrow vertical dike, a part of the East-rock dike. It presents a precipitous front to the south; but northwards the slope is gentle, and is formed of sandstone. This dike of hard trap, and the adjacent hardened sandstone, stood up like a wall in the path of the great glacier; and its surface is strongly rounded off, grooved, polished, and striated by the ice. This cutting is best seen on the surface of the hard sandstone. The direction of the glacier appears to have been from the north-east. In addition to the glacial scratches, there is a series of transverse valleys or depressions having about the same direction. These appear to have been formed by the ice following the lines of outcrop of the harder beds of sandstone underlaid by soft red shales.

Heavy bowlders of hard trap are irregularly distributed in sandy gravel on the north slope. There are some large bowlders of quartz, but granite bowlders do not occur. Most of the bowlders have flattened sides, showing extensive abrasion. They are generally ellipsoidal in form, and are often broken at one

end. The quartz bowlders are found in forms which indicate that they were firmly held in the ice, first in one position, then in another, some of the smaller masses having several facets. A great variety in the nature of the soil is observed. There are deposits of clean sand and of bowlder-clay. These peculiarities, and the abraded bowlders, indicate the *moraine profonde*, or under-moraine. The large pot-holes cleanly cut in the sandstone of the north slope are referred by Prof. Blake to glacial origin, being similar to the 'giants' kettles' of the glaciated regions of Norway, and formed, probably, by vertical torrents falling through the ice-sheet. — (*Conn. acad. arts and sc.; meeting* Jan. 17.) [314

MINERALOGY.

Minerals of the cryolite group. — A note that several minerals of this group, occurring in small quantity, have been identified from a locality near Pike's Peak, Col., by W. Cross and W. F. Hillerbrand of the U.S. geological survey, is of interest. — (*Amer. journ. sc.*, Oct., 1882, 281.) S. L. P. [315

Vesuvianite. — Crystals from Kedalbék (Eastern Caucasia), rich in planes, and brilliant, have been chemically and crystallographically examined. The results of analysis agree closely with the accepted formula $H_2R^{II}_3R^{IV}_2Si_7O_{29}$. Four planes new to the species were identified. — (*Zeitschr. krist.*, vii. 344.) S. L. P. [316

Humite. — As the result of the crystallographic study of this mineral from Ludugrufvan (Sweden), Hj. Sjörgren has shown its analogy to the crystallized humite from Vesuvius, though the number of occurring planes is much smaller. The associations of the mineral from this locality is very similar to that occurring at Brewsters, N.Y.; the humite, associated with magnetite, calcite, and brucite, occurring from pure, through all stages of decomposition into serpentine. The pure, unaltered crystals were mostly found imbedded in calcite. In thin sections under the microscope, the appearance is almost identical with that of olivine. The author entering into a discussion of the chemical composition of this, and the closely allied minerals clinohumite and chondrodite, states that the presence of water in all these minerals has often been noted; and, although it fails to appear in most of the published analyses, there is, in most cases, a deficiency of constituents given, in order to make up the full 100 per cent; and this deficiency increases as the quantity of fluorine decreases. Provided this deficiency is due to undetermined water, it might be taken to indicate, that, where there is a deficiency of fluorine, a univalent hydroxyl group enters into the mineral as an isomorphous replacement of a part of the fluorine. Taking this into consideration, and also the varying ratios of Si : R (R=Mg and Fe), he finds that the three minerals agree closely with the following formulae, arranged so as to show their relation to one another and to olivine: olivine, $Mg_{12}[SiO_4]_6$; clinohumite, $Mg_{10}\left[Mg\left(\frac{OH}{F}\right)\right]_4[SiO_4]_6$; humite, $Mg_9\left[Mg\left(\frac{OH}{F}\right)\right]_6[SiO_4]_6$; chondrodite, $Mg_8\left[Mg\left(\frac{OH}{F}\right)_8\right][SiO_4]_6$. These formulae are derived principally by calculation from the older analyses; and it is hoped that more exact analyses may be made to clear up more fully the true chemical nature of these minerals. — (*Zeitschr. krist.*, vii. 344.) S. L. P. [317

Rezbanyite. — Under this name, a new mineral resembling cosalite ($2PbS, Bi_2S_3$), but with varying composition, has been described by A. Frenzel. It occurs along with other bismuth and lead minerals at Rezbanya, Hungary: structure, massive, with no decided cleavage; lustre, metallic; streak, black; hardness, 2½–3; gravity, 6.09–6.38. Three independent analyses were made, which led to the formula $4PbS, 5Bi_2S_3$. — (*Min. und petr. mitth.*, v. 175.) S. L. P. [318

Alloclasile. — This mineral, which occurs at Oravicza (Hungary) in small crystals resembling mispickle, has been newly investigated by A. Frenzel, and shown to be in composition also closely related. On account of the rarity of the crystals, enough of them could not be obtained for analysis; but several analyses from specimens of massive material were made which agreed nearly with the formula (Co Fe) (AsBi) S. It varies from mispickle in that most of the iron has been replaced by cobalt, and part of the arsenic by bismuth. — (*Min. und petr. mitth.*, v. 179.) S. L. P. [319

METEOROLOGY.

Thermal belts of North Carolina. — Professor J. W. Chickering read a paper on this topic, reciting the observations of Mr. Silas McDowell and others. The valley of the Little Tennessee river, in Macon county, is about 2,000 feet above tide. When the thermometer indicates a temperature of about 26° F., the frost extends about 300 feet in vertical height up the mountain-sides, and there ceases, appearing again 400 feet higher. In the intervening belt, the most delicate plants remain untouched; and so sharp are the dividing-lines, that sometimes one half of a shrub may be frost-killed, while the other is unaffected. Following a tributary stream upward from the valley, one passes three mountain-barriers, and enters in succession three valleys, the highest of which is plateau-like, and 3,900 feet in altitude. The vernal zone appears in each valley, rising as the valleys rise, but somewhat less rapidly; so that in the highest it is only 100 feet above the plateau. In this frostless zone the Isabella grape not merely has ripened for twenty-six consecutive years, but is free from mildew, blight, and rust. In Polk county a similar belt is said to skirt the Tryon mountain, extending from 1,200 to 2,200 feet above tide. This is untouched by frost until the latter part of December, and is usually free from snow; while the mountains above and the valleys below are covered. The peculiar stratification of the air indicated by these statements merits scientific investigation. — (*Phil. soc. Washington; meeting* Feb. 24.) [320

GEOGRAPHY.

(*Asia.*)

Riebeck in India. — Dr. Riebeck writes, that after returning with rich collections from Darjiling to Calcutta, where an industrial exhibition gave him opportunity to procure many specimens, he went to Chittagong, and secured in a relatively short time photographs and face-casts of twelve different hill-tribes. A famine in the hill country had driven the suffering people into the British territory, not with any warlike designs as had been reported, but simply to obtain food, mostly rice from the government stores. The poor people often came from twenty-five days' journey beyond the British boundary, and many of them had never seen Europeans before. — (*Verh. gesell. erdk. Berlin*, ix. 1882, 504.) W. M. D. [321

Regel in central Asia. — Dr. Regel reports a number of new geographic details to the Russian geographical society from the region of Karategin and Darwas, about the sources of the Amee River.

The climate is clear and dry in summer; but in the long winter there are heavy snowfalls, preventing communication between the villages. On the way eastward to Karategin, he crossed three nearly meridianal mountain ranges. South-east of the Wakish, the ranges run north-east and south-west; and after crossing the Pandj (Pandsch), the great Badakshan range is fully parallel to the Hindu-Kush. The Wakish, Pandj, and Wandj rivers are respectively 100, 100–170, and 60–100 metres broad. The natives regard the latter two as the true head-waters of the Amee. They both have turbid water, and in winter carry cakes of ice. There are no bridges over the Pandj, and the stream is crossed on goat-skin floats. The population of these villages is very mixed: some of the tribes seem of true Aryan type. For the last fifty years the country has been desolated by wars, in which the prisoners were carried off to be sold as slaves at Buchara, Kashgar, and Badakshan. — (*Verh. ges. erdk. Berlin*, ix. 1882, 505.) W. M. D. [322

(*Africa.*)

New expeditions for eastern Africa. — The geographical society of London has given Mr. Joseph Thomson command of an expedition to enter eastern Africa from Zanzibar, with the object of exploring a direct route to the eastern shores of Victoria Nyanza, and examining Mount Kenia. Thomson left England on Dec. 13. He has previously led two expeditions in this region with excellent success, and a good share of scientific results. He is now preceded in the field by Dr. G. A. Fischer, for whose expedition the Hamburg geographical society has appropriated 15,200 marks. Fischer was to leave Pangani last November, and march toward Liconono, then to the south-eastern shore of Victoria Nyanza, and the little-known Baringo Lake, and, if possible, to go on farther north. Parts of this region have been specially studied by German explorers: Erhardt, Krapf, and Rebmann, in 1848–49; v. d. Decken, Kersten, and Brenner, in 1859 and 1862; Hildebrand, in 1875–77; and Denhardt, and Fischer himself, in 1878. — (*Proc. roy. geog. soc.*, 1883, 32; *Verh. ges. erdk. Berl.*, 1882, 399; *Ausland*, 1882, 978.) W. M. D. [323

Dr. Junker on the Uelle. — This persevering explorer joined an armed Egyptian party a year ago, and followed down the valley of the Uelle, gaining some information about its probable lower course, and returning by a détour to the south and east. It seems that Uelle is simply, as is so often the case, the local word for *river*, and that its name is really Makua; so with its southern branch marked Nomayo on Schweinfurth's map, which should be Bomokandi. Dr. Junker concludes from native information, that the Makua Uelle is the head stream of the Shari; and that the Nepoko, rising farther east and flowing south, is Stanley's Aruwimi branch of the Kongo. He also refers to a large lake south of the region he passed through, and doubtless corresponding to the lake reported from upper Egypt by Lupton; Junker's Makua being presumably the same as Lupton's Bahr el Makwar. — (*Proc. roy. geogr. soc.*, Jan., 1883; *Peterm. mittheil.*, 1882, 424, 441.) W. M. D. [324

BOTANY.

The chromatophor of algae. — While at the zoölogical station in Naples, Prof. Fr. Schmitz studied the arrangement of the coloring matter in the cells of marine algae; and he has since extended his observations to the coloring matter of other groups of plants. At present he gives only the results of his observations on algae, reserving for a future publication his researches on Archegoniata and phaenogams. In a few plants, as the Phycochromaceae, the coloring matter is uniformly diffused through the cell; but in most cases it has a definite outline, and forms a mass to which Prof. Schmitz gives the name of chromatophor. In the higher plants the chromatophor is principally represented by chlorophyl grains; but in algae it is often represented by bands, stellate masses, or large irregularly shaped bodies. Schmitz finds in the chromatophors of many algae more or less spherical bodies to which he gives the name of pyrenoids. They occur in some red and brown algae, and are very common in green algae. Schmitz shows that the chromatophors of algae are capable of division, and that new chromatophors are always formed from some already existing chromatophor and not from the protoplasm itself, using the word in its strict sense. In some cases it appears to be the case that pyrenoids which are in reality nuclei of the chromatophors have been mistaken for the nucleus of the cell itself; as in the case of Anthoceras, where it has been generally supposed the cell nucleus was surrounded by an irregular mass of chlorophyl. — (*Verhandl. natur. vereins Rheinl. u. Westfalens*, 1883.) W. G. F. [325

American Characeae. — The manuscript of the late Alexander Braun, of Berlin, has been edited by Nordstedt, who has added notes and observations of his own; and the whole forms the most complete monograph of the Characeae yet published. In it appear for the first time in print descriptions of several American species which were hitherto only known from herbarium names. The monograph includes one hundred and forty-two species and sub-species. — (*Abhandl. acad. wiss. Berlin*, 1882.) W. G. F. [326

The relations, as regards size, of the woodcells in Coniferae and other trees. — Dr. Ewald Schulze has repeated the extensive observations of Sanio, and has obtained results which appear to confirm them. He has further shown, that the principles laid down by Sanio may be extended to a much wider range of ligneous plants. — (*Zeitschr. f. naturwiss.*, 1882, no. 3.) G. L. G. [327

Relations of organic matters in the soil to the process of assimilation in the sugar-beet. — The old experiments have been repeated and extended by Corenwinder, but have added very little to what was known before. He states, however, that the beet, when cultivated in a soil very rich in carbonaceous matters, can absorb more or less carbon from that source. As to the use which is made of this carbon, he is unable yet to express a positive opinion; so the question has not been materially affected by his present work. — (*Comptes rendus*, Jan. 2.) G. L. G. [328

Detection of adulterations in tea. — Mayer calls attention to the peculiar character of the felted hairs on the leaves of certain Camellias, and to the universal occurrence of firm cells, which are almost true sclerenchyma, in the parenchyma of the under side of the leaves of tea. The cells are said to be best seen when thin sections of soaked leaves are first treated with dilute potassic hydrate, afterwards washed with alcohol of 50% which contains 10% hydrochloric acid, and finally placed in glycerine and water. — (*Zeitschr. f. naturwiss.*, 1882, no. 3.) G. L. G. [329

(*Fossil plants.*)

Laminarites Legrangei. — Saporta reviews the characters and conformation of this species, described formerly by Saporta and Marion in their work on the Evolution of the vegetable kingdom, p. 101, f. 34. Nathorst of Stockholm had considered it as representing the tracks of animals. From better, very large specimens, Saporta has seen it composed of bands or

lamellae closely placed, and crossed at right angles by others apparently superimposed and of the same nature. He has been able, by separating the layers composing the thallus, to see that these bands anastomosed at their points of conjunction, leaving between them empty spaces of the same width as the bands, composing a kind of latticed thallus like that of species of Agarum. — (*Comptes rendus*, June 26.) L. L. [330

Permian plants from eastern Russia. — After giving a vertical section of the upper Permian of Kargalinsk, Twelvetrees describes a Cardiopteris, two species of Walchia, one Lepidodendron, one Schizodendron, one Anomorrhoea, a Caulopteris (?), and four Calamites. These plants have, taken altogether, a remarkable analogy with a group of vegetable remains procured from strata near Fairplay, Col., and which, by their characters, are of lower Permian age. The affinity is rendered the more remarkable by the fact, that, as remarked by the English author, "The list of the species of plants has a paleozoic aspect, but a secondary one as respects the reptilian remains." The same can be said of fossil remains of Fairplay, the plants being all of paleozoic types; while the insects, according to the researches of Mr. Scudder, are mesozoic. — (*Quart. journ. geol. soc. Lond.*, no. 152.) L. L. [331

ZOÖLOGY.

(Geographical distribution.)

The relations of the 'nearctic' region. — A re-examination of Wallace's palaearctic and nearctic regions is being made by A. Heilprin.

Two propositions are discussed: namely, 1°, whether the nearctic region is entitled to independent rank; and, 2°, if not, to which of the two regions, neotropical or palaearctic, does it belong. For the mammals, Wallace's tables are recast. It is shown, that, while eighteen neotropical and nineteen palaearctic families occur in the nearctic region, only eleven genera are common to the nearctic and neotropical regions, as opposed to twenty-one genera common to the latter region and the palaearctic. The number of genera peculiar to the nearctic region amounts to 35 per cent; to the palaearctic, 35 per cent; to the oriental, 46 per cent; to the Australian, 64 per cent; to the Ethiopian, 63 per cent; and to the neotropical, 78 per cent. The number of families peculiar to the nearctic is given as one; to the palaearctic, none; while all the remaining regions have from seven to nine. By uniting the first two regions, the proportion of peculiar genera is raised to fifty per cent, and the number of peculiar families, including Rogiferidae, Alcadae, and Copridae (though without warrant in this case, as it appears to us), to seven, thus bringing the combined regions into rank with remaining divisions of the globe. In conclusion, it is considered proved: "first, that by family, generic, and specific characters, as far as mammals are concerned, the nearctic and palaearctic faunas taken collectively are more clearly defined from any or all the other regions than either the nearctic or palaearctic taken individually; and, second, that by the community of family, generic, and specific characters, the nearctic region is indisputably united to the palaearctic, of which it forms a lateral extension."

It would appear that the first conclusion does not entirely satisfy the first proposition, and that the second conclusion should be reversed; since, according to the percentages given, the palaearctic region is the lateral extension of the nearctic. Among the many thoughts to which the paper (which is not yet completed) gives birth, the following may be recorded: 1°. Even after combining the two northern regions, the interval between their percentage of peculiar genera and that of the region having the next higher number is greater than that between percentage of the palaearctic region alone and that of the region having the next higher number. 2°. The number of families peculiar to the combined regions, according to Wallace's tables (excluding the ungulate subfamilies), is but one more than the number of families peculiar to the nearctic region alone according to Allen's tables. 3°. The character of the peculiar families inhabiting the Australian region is very different from that of those of the other regions, since in the former case six of the eight families belong to one order, while in the latter the families are divided among the many orders of Monodelphia. 4°. A knowledge of what regions are occupied by a group of animals is of more importance to the zoölogist than the knowledge of what animals occupy any region or regions; especially if, in the latter case, no account is taken of extinct forms. — (*Proc. acad. nat. sc. Philad.*, 1882, 316.) F. W. T. [332

(General physiology and embryology.)

Action of digitaline on the circulatory organs (preliminary note by H. H. Donaldson and L. T. Stevens). — The continuation of the experiments begun last year has yielded the following results: the work done by the heart of the common frog is decreased by digitaline, whatever the dose, as was previously shown to be the case for the heart of the 'slider' terrapin. In both frog and terrapin, the decrease occurs, whether the aörtic valves are intact or not. Variations in arterial or venous pressure do not affect the result.

By a method permitting direct measurement of the fluid circulating through the viscera and lower extremities in a unit of time and under constant pressure, it has been determined for the frog that the arterioles are constricted by digitaline. On this point the terrapin has not yet been investigated. Digitaline has also been shown to increase mean blood pressure in both frog and terrapin.

We have, then, for the frog under digitaline a decrease in the work done by the heart, a rise of mean blood pressure, and a constriction of the arterioles. The first and second of these points have been already demonstrated for the terrapin as well. — (*Johns Hopk. univ. circ.*, Feb., 1883.) [333

Origin of the heart. — Professor Bütschli has advanced a hypothesis of the phylogenetic origin of the heart and blood-vessels, which has much plausibility. He suggests that the heart is a remnant of the primitive or segmentation cavity of the embryo, and is not derived from the secondary or permanent body cavity (schizocoele or enterocoele). He endeavors to reconcile this view with the accounts of the development of the heart in vertebrates, maintaining that it probably arises as a fissure in the mesoderm, remaining as a permanent part from the temporary primitive cavity. More support for the hypothesis is found in arthropods; for it has been observed in several forms that the two edges of the mesoderm approach one another in the median dorsal line, leaving a space between them, which belongs to the primitive cavity. This space becomes the heart. Sometimes it is cut off before, sometimes after, the mesoderm is split into segments. These observations were upon the bee (Bütschli), Geophilus (Metschnikoff), and Branchipus (Claus). An investigation to answer the problem propounded by Bütschli would, it may be safely said, prove fruitful and interesting. — (*Morph. jahrbuch*, viii. 474.) C. S. M. [334

Molluska.

Anodonta fluviatilis. — Dr. Jos. Leidy directed attention to a basketful of living fresh-water mussels, Anodonta fluviatilis, collected from ponds in the marl of New Jersey. He had found them on examination to be exceedingly prolific. The pregnant females have the branchial uteri, as they have been appropriately named by Dr. Isaac Lea, enormously distended with perfected embryos. These appear with a cinnamon-brown shell having a conspicuous spinous tooth or hook to each valve, and are provided with long byssal threads. Wishing to ascertain the proportionate amount of embryos, the following calculation was made: in an individual six inches long, the soft parts were weighed, and found to be 135.44 grammes. The branchial uteri weighed 64 grammes, and the inner gills 7.34 grammes. Supposing the latter to be of the same weight as the outer gills free from embryos, this weight subtracted would leave 56.66 grammes as that of the embryos, and 78.78 grammes as the weight of the rest of the animal. He estimated that there are 1,280,000 young in the branchial uteri of each animal.

The mussels were infested with many water mites creeping about among the gills, and the young of the same were found embedded in the mantle. The mite appears to be identical with the Atax ypsilophorus described one hundred years ago by Bonz, as infesting the Anodonta cygnea of Europe. It is of a dense black color, with a Y-shaped yellow mark on the back. Our Unio complanatus had been found infested with a mite which is probably the Atax Bonzi described by Claparede from European unios. If our parasitic mites are identical with those of European mussels, it not only makes it appear probable that they are of common origin, but renders it the more probable that this is likewise the case with their hosts, even if these are not regarded of the same species. — (*Acad. nat. sc. Philad.; meeting* Feb. 13.) [335

Insects.

Luminosity of fire-flies. — Considering the popular interest in the subject, we have very few investigations of the light-giving organs of insects; but for all this, as the latest student of their anatomy, Heinrich Ritter v. Wielowiejski, observes, there are plenty of contradictory statements.

The photogenic organs, as Huxley calls them, consist of thin whitish plates, resting on the ventral walls of the penultimate and antipenultimate abdominal rings of the abdomen, which is in these spots transparent to allow the emission of the light. In the female glow-worm there are also two small accessory light-organs in the last ring. These photogenic plates are composed of 'parenchymal cells,' richly supplied with nerves and tracheae. The upper and lower strata of the plates, considered as distinct by former authors, really differ only in the nature of the contents of the parenchymal cells above and below. These cells are morphological equivalents of the 'fat-body' (as maintained by Leydig), and physiologically are glandular. The production of light results from the slow oxidization of materials formed, under control of the nervous system, by the parenchymal cells. The light may continue to shine long after the death of the cells, and therefore is not a property of the living protoplasm as such.

The stellate 'terminal tracheal cells' discovered by Schultze have no connection with the production of light, nor are they the ends of tracheae. They belong, in fact, to the matrix, or peritoneal sheath, of the tracheae, which is spread out about the point where the fine tracheae branch into still finer 'tracheal capillaries,' which latter want the spiral threads of the tracheal stems. The 'capillaries' seldom end blindly, but anastomose with each other into a sort of network. They do not penetrate into the parenchymal cells, but seem to run over their surface, twining irregularly around them on all sides. Some (or all?) of the parenchymal cells are connected with fine nervelets.

The most useful reagent for the study of the light-organs was a solution of osmic acid (from 1 to 0.1 per cent) in which the living insects were immersed, and later transferred to alcohol, or to a mixture of alcohol, glycerine, and water.

The eggs were found not to shine by their own light, but as stated by Newport, though he has been contradicted by Owsjannikow, are sometimes rendered luminous by an accidental coating of the luminous substance of the light-giving organs, which might easily be ruptured by the pressure of the masses of eggs contained in the abdomen of a gravid female.

While the luminosity of the adult fire-flies is evidently useful in bringing the sexes together, it remains to explain the luminosity of the larvae and pupae, which are thus of course made conspicuous to the eyes of insectivorous birds and other animals. Von Wielowiejski suggests that their bite, already known to be poisonous to the snails on which the young fire-flies feed, is to some extent poisonous to the enemies of the latter. If this is the case, or if, as it may be suggested, they are disagreeable to the taste, the light would of course serve as a danger-signal to protect its givers from attack.

The author finally calls attention to larval or embryonic characteristics found in adult Lampyridae. Besides the well-known larval form of the adult female glow-worm, the 'terminal tracheal cells' are embryonic structures. There is also the occasional occurrence, on the muscular fibres, of remains of the embryonic formative cells, and the presence of the large free cells in the body cavity.

The paper appears to be the result of careful and reliable study, and, if somewhat diffuse, is still a most valuable contribution to our knowledge of a difficult subject: it contains, besides the points already mentioned, a number of observations on the fat-body, nervous system, cuticula, etc. — (*Zeitschr. wiss. zool.*, xxxvii. 354.) K. B. [336

VERTEBRATES.

Integumentary appendages. — Mr. J. A. Jeffries spoke of the structure of these parts in birds, and compared these with each other and the appendages of other vertebrate groups. Having stated that the same layers of the epiderm could be found in the development of all the appendages, and that many of the layers seemed to be the result of physiological conditions rather than of morphological value, he passed to a comparison of the appendages.

Feathers differ from the scutae of the tarsus in that the internal surface of the mucous layer becomes exposed to the air; they arise as hemispherical knobs, not as folds; they may grow upon the scutae; and the final structures are totally distinct. The supposed scale-like nature of penguin-feathers has, moreover, been proved to be a fallacy.

Scutae are separated from the scales of reptiles, with which they have have been assumed *a priori* to be homologous, in that they arise as folds; they have not the complex structure of scales, they shade into the papillae of the plantar surface of the toes, and they may bear feathers. Finally, any point of resemblance between feathers and scales also exists between the two, and the folds on the tail of the rat or opos-

sum; in fact, there is very little difference between the first and the last; yet one would hesitate to call the folds on the opossum's tail scales.

The claws are shown by their positions, structure, and development to be homologous with those of other vertebrates. Wattles, spurs, and the bill seem to be special formations.

Mr. Jeffries finally stated that he had been unable to find any resemblance between the papillae in the mouth and feathers; the papillae being comparable with those of other vertebrates, and the jelliform structure found in the ducks being due to a lack of development of certain epithelial cells. — (*Bost. soc. nat. hist.; meeting* Feb. 7.) [337

Motor disturbances following lesions of the internal ear. — Operative difficulties have hitherto prevented any extended series of experiments on mammalia in this connection. Vulpian has lately employed the method of injecting irritating liquids into the external auditory meatus of rabbits. A few drops of a 25 per cent solution of chloral hydrate in water, when injected, cause motor disturbances within fifteen minutes; these become more pronounced, and next day attain a maximum; the limbs are moved with uncertainty in locomotion, and the animal frequently falls; the head is twisted on the spinal column so that the cheek of the side on which the injection was made is turned upwards; there are circus movements towards the side of the operation; the animal rolls over and over around its longitudinal axis; there is nystagmus; and also the muscles of the two eyeballs cease to be co-ordinated in their action, so that one eye is turned upward and the other towards the ground. Post-mortem examination showed no lesion in the brain cavity, but destruction of the labyrinth so extensive that no statement as to any specific connection of any one part of the internal ear with the motor disturbances could be made. The phenomena are much less marked when dogs are substituted for rabbits. — (*Comptes rendus*, cxvi. 1883, 90.) H. N. M. [338

Reptiles.

The carpal bones of Dinocerata. — During a communication on the tarsus and carpus of the Dinocerata, Mr. Jacob L. Wortman referred to Prof. Marsh's statement, that the scaphoides in the proximal row of the carpus is supported below by the trapezium and trapezoides, and that it does not touch the magnum. In the figure of the anterior foot, however, which Prof. Marsh published with this description, he makes the scaphoides to articulate with the magnum, although stating directly to the contrary. The speaker had recently made a careful study of the remains of Uintatherium, belonging to Princeton college, and had found that the scaphoides does touch the magnum; thereby establishing the fact that Prof. Marsh's figure is right, although his description is wrong. The carpal bones, therefore, of the proximal and distal rows form distinct interlocking series; indicating that the Dinocerata can no longer remain as a sub-order of the Amblypoda, but must be placed in the Diplarthra of Cope, which includes the Artiodactyla and Perissodactyla, and corresponds with the Ungulata of authors. — (*Acad. nat. sc. Philad.; meeting* Feb. 20.) [339

ANTHROPOLOGY.

Aborigines of Andaman islands. — In our childhood we imbibe the opinion that African and Negro are co-extensive; but ethnology acquaints us with these two propositions, — not all Africans are Negroes, and, not all Negroes are Africans. The natives of the Andaman islands, off the west coast of Farther India, are a woolly-haired black race, like the negrittos of Malacca and the Philippines. Mr. E. H. Man, who has lived among them, has been giving to the British anthropological society a series of sketches concerning them, the last of which appeared in a late number of the journal. Many precious facts respecting their language are presented. For instance, they coin native compounds for new ideas: as, *ârla*, daily, and *ik-yâ'b*, repetition, for prayer. They have a poetic dialect that subordinates to rhythm the forms of words, and even sentential structure. A very elaborate system of possessive pronominals is in use. There are, of these, three principal classes: 1, for nouns denoting human objects; 2, for names of parts of the body; 3, nouns of relationship. Again, No. 2, has seven subclasses: I. Used with names for head, brain, neck, chest, heart, etc. II. With hand and foot, and their parts. III. With shoulder, arm, breast, face, temple, etc. IV. With body, back, thigh, calf, elbow, stomach, liver, etc. V. With leg, hip, loin, bladder, etc. VI. With mouth, chin, lip, throat, etc. VII. Only with waist. Class 3 has eight subdivisions.

The word-construction is both prepositional and postpositional; so much so that the two forms interfere with each other's grammatic function.

Owing to a singular practice of adoption, it is rare to see a child above six or seven years residing with its parents. It is considered a compliment for a married man, after a visit, to ask his host for one of his children. Indeed, the *soi-disant* father, may, on a similar occasion, pass the child on farther, without referring to the real parent. To prevent improper flirtations among the lads and lassies, they paint the suspected parties, one red, the other white: of course they cannot mutually embrace without partially exchanging color. Marriage is forbidden among near relatives. Relationships are traced in both lines, and the system with reference to either sex is identical; but the record fails after three generations.

Children are named before they are born, after some friend of the parent; there being no distinction of sex in these titles. As they grow up, a male or female affix is applied. At puberty the females receive the 'flower' name, after a plant blooming in the month when that takes place. The young men receive an epithet name. Between the eleventh and the thirteenth years commences the initiatory abstinence from turtle, honey, pork, fish, and other *choses défendues;* which lasts for a period of years, and is broken at last with great ceremony and rejoicing. Mr. Man takes occasion to correct a great many marvellous stories about the unchastity and inconstancy of the Andamanese, and paints a very pretty picture of their simplicity and fidelity in matrimonial matters. The marriage-ceremony is described in charming style.

Much ceremony is practised in the burial of the dead; infants being deposited under the hearth of the hut where they died, and adults upon a 'machan,' or platform, in the jungle, or in a grave. Temporary migrations in either case follow death, in order to allow the spirit of the deceased full range around the old haunts. After a proper time the dead are exhumed, their bones cleaned and made into jewelry and mementos. The belief in spirits is evident from the ceremonies accompanying interments.

Friends, at meeting, stare at each other until the younger speaks; relatives embrace, and howl hideously. For each particular kind of meeting there is a special form of salutation, in which tears form the chief ingredient.

Fire-making is unknown; but the modes of pre-

serving the fire furnished by the active volcano of one of the islands are very ingenious. Many misstatements have been made concerning their former ignorance of fire.

The closing part of Mr. Man's paper, relating to superstitions, beliefs, and mythology, furnishes a tempting field for the prolongation of this notice; but the want of space forbids. — (*Journ. anthrop. inst. Gr. Br.*, xii. 117.) [340

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PSYCHOLOGY.

Apparent size of magnified objects. — A paper (to appear elsewhere) was read by Prof. W. H. Brewer, in which he gave the results of several hundred estimates by as many different observers chosen from different classes of people, of a common insect as seen magnified by a microscope. These estimates were found to vary from a fraction of an inch to several feet, the actual apparent size at ten inches being a little over four inches. — (*Conn. acad. arts sc.; meeting*, Dec. 20.) [343

Experiments in binary arithmetic. — Simple addition involves several distinct but nearly simultaneous mental operations, and a capital of more than fifty propositions committed to memory. The object of the experiments by the author of the paper, Mr. Henry Farquhar, was to test the possibility of diminishing the mental strain, and consequent liability to error, by the use of numbers expressed in powers of 2, the mental work being reduced to counting similar marks and halving their sums. Columns of numbers of six or eight figures each were written with the ordinary, and with various forms of binary, notation; and comparative additions were made. To avoid confusion of columns it was found best to give different shapes to the marks denoting neighboring powers of 2; and, for brevity of expression, two or more of them were combined in one written figure. About seventy combinations were tried, with various results. With the best combination, addition required only three-fourths the time taken with ordinary figures; and this was reduced to one-half when the binary notation was taught to a person unskilled in arithmetic.

The only natural division is by bisections; hence the superior convenience of a binary scale of weights; and hence another reason for endeavoring to introduce a binary arithmetic.

In the discussion which followed, Mr. William B. Taylor said the world was losing so much by the use of the denary arithmetic, that even a single generation might find economy in substituting the octonary. The paper had especial value in that it proved the ability of binary arithmetic to compete with the established system in rapidity of computation. — (*Phil. soc. Wash.; meeting* Jan. 13.) [344

Varying the thermal background of reflex perception. — The background of conscious perception, physiologically speaking, is defined by W. T. Sedgwick as "that standard (usually unconsciously held) with which we compare any stimulus which awakens consciousness." We perceive difference of relative intensity between a specific stimulus and its background. The latter may vary so that a stimulus which will to-day cause consciousness or motion will not do so to-morrow. Instead of studying the reflex background by means of inhibitions, the author varies the background as a whole thermally, and observes its effect on reflexes. A reflex or headless frog may be heated so slowly, that, although the heart may beat very fast, *rigor caloris* may be caused without any motor re-action of its limbs. If the heart be tied beforehand, reflexes occur from gradual heating.

This the author thinks explained by assuming, that, in the first case, the hot blood passing inward equalizes the progressive heating throughout, or changes the thermal background; while in the second case, with no circulation, the background is fixed, and the surface temperature rises to the point of difference which causes movement. — (*Johns Hopk. univ. circ.*, Feb., 1883.) G. S. H. [345

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

Manitoba fishes. — A collection of fishes from Manitoba, the first received for twenty years, shows that the fish-fauna of that region does not differ materially from that of the lake states.

Number of visitors in 1882. — The reports of the doorkeepers, which have been regularly made since Feb. 8, 1882, show that the average daily attendance at the museum building for that year was 535 persons, and, at the Smithsonian building, 488 persons. Estimating upon this basis, the attendance for the year 1882 may be placed at 183,265 for the museum building, and 152,822 for the Smithsonian building. When the re-arrangement of the collections in the latter

building is completed, the number of persons entering the doors will undoubtedly be the same as the number entering the museum building. The average daily attendance upon the museum at present is about 1,200.

Fisheries exhibit. — A preliminary display of the fisheries exhibit to be sent to London took place in the halls of the museum on the evenings of the 26th and 27th insts. About five thousand invitations were distributed by the commissioner of fisheries for the first evening, and were universally responded to. On the second occasion the general public was admitted without reserve. The exhibit may be pronounced remarkably comprehensive in scope, and complete in detail. The mounting of the various objects has been done in a very careful and artistic manner. Packing will begin at once.

Geological survey.

Division of mining statistics and technology. — According to an act of Congress passed at the last session, the survey is charged with the duty of collecting and publishing statistics of the mineral industries of the country (other than gold and silver mining). The plan also includes technical discussions and industrial notes; the general aim being to furnish matter of a practical character, thus correlating the purely geological work of the survey. The reports are to be issued as semi-annual bulletins, in octavo, the first of the series bearing date of July 1, 1883.

The scope of this work embraces a wide range of topics, among which are coal, iron, petroleum, copper, lead, zinc, quicksilver, nickel, tin, manganese, antimony, bismuth, salt, graphite, phosphates, barytes, asbestos, borax, gypsum, sulphur, mica, felspar, and many other substances; together with lists of localities of the useful minerals, statistics of mine accidents, etc.

Although mining statistics have been for many years published as government reports in Great Britain, France, Belgium, Holland, Russia, Germany, Austria, Sweden and Norway, Victoria, New South Wales, Queensland, Nova Scotia, and other countries and colonies, the United States have been hitherto without accounts of their mineral products, excepting such as are included in the reports of mining commissioners for the precious metals, state mineralogists, state geological surveys, and in census returns and the commercial reports of the bureau of statistics. While much creditable work has been done, and valuable information imparted, in a desultory way, both have been limited by local restrictions, or have wanted continuity. The general government has never before attempted systematic effort in this direction.

Bureau of ethnology.

Explorations of the pueblos of Tusayan. — During the earlier part of the past field-season, one of the parties of the bureau, under the charge of Mr. Victor Mersdeleff, has been at work among the pueblos of the ancient province of Tusayan, making such measurements, drawings, and plans, as will enable him to prepare models of the seven Moqui towns, on a scale sufficiently large to exhibit not only the architectural details of the villages themselves, but also the essential features of the high, precipitous mesas upon which they stand.

The party first visited the towns of Té-wa, Sechum-o-vi, and Wol-pi, — all built, in the order named, on one mesa promontory.

It is an interesting fact that the inhabitants of Té-wa, although in such close proximity to the other towns, have preserved their own customs and institutions in many respects entirely distinct from their neighbors. They manufacture a certain quality of undecorated pottery, which is not found at any other of the Moqui towns. It will be well represented in the collections from this region.

Wol-pi is remarkable for the position it occupies on the extreme point of the mesa peninsula, the neck connecting it with the main body of the mesa being not more than twelve feet wide. It is the largest of the three villages; and the small, rocky promontory on which it is built is well crowded with clusters of dwellings. In many cases, a back wall is built within a few inches of the edge of the vertical precipice; and the weathering and undermining of the rock has, in some instances, disturbed the foundations of the homes, compelling their abandonment. The trails from these villages to the plains below are very steep and rugged, in some cases descending by means of rude steps in crevices between the rocky wall of the mesa, and detached slabs of rock that have fallen from above.

The next field studied was the town of O-rai-be, which is by far the largest of the entire group, and the most isolated, maintaining very little intercourse with strangers. This pueblo is arranged with much regularity, considering the extent of ground it covers. The vast, irregular, hive-like cluster of houses usually seen in other pueblos is not found here. The buildings are arranged approximately in rows, and never exceed four stories in height. The fact that several additions to houses were being built during our short stay would seem to indicate that these people are increasing.

The three towns of the 'middle mesa' were the last group visited. Two of them — Mē-shong-i-ni-vi and Shi-pau-a-lu-vi — are quite close together; while Shong-a-pa-vi, the third, is on a spur of the same mesa, three miles to the westward. The latter is the most regularly planned of all the towns. Entrance from the roof — a conspicuous feature in the architecture of more exposed pueblos — is here found only on the first mesa, and then only occasionally, many houses being unprovided with them. The natural inaccessibility of these villages would seem to render this precaution unnecessary. It is a noteworthy fact, that, in almost every instance, the terraced side of the houses, with all the doors and windows, face eastward; the back of each row usually being a vertical wall without receding stories, and with very few openings. Even when parallel rows occur, they occupy the position stated above, instead of being built facing each other.

Incidentally to the work among these pueblos, the party visited and surveyed the ruins of a very extensive ancient pueblo, situated ten miles east of the first Moqui mesa, and known by the Navajo name of 'Talla Hogan.' From the data collected, models can be made which will be accurate as to the relative position and size of minor features; such as doors, chimneys, ladders, etc.

Upon the completion of the surveying-work, Mr. Frank H. Cushing joined the party, and a collecting expedition was organized to work among these Indians. In addition to a very full and complete collection of the modern pottery, baskets, and dance-paraphernalia, there were secured many pieces of ancient ware of rare form and decoration, and in a perfect state of preservation. The Moquis stated that some of these had been dug up on the sites of ancient pueblos; and, indeed, many of them bear evidence of recent exhumation. A few, however, seemed to be considered as heirlooms. Some of the villages appear to entertain reverence for certain ruin

serving the fire furnished by the active volcano of one of the islands are very ingenious. Many misstatements have been made concerning their former ignorance of fire.

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Pebbles resembling artificial objects. — Dr. Jos. Leidy called attention to a collection of large pebbles, which illustrated how closely certain natural forms may sometimes resemble works of primitive manufacture. The pebbles have the general shape of human feet, and might readily be supposed to have been used as lasts upon which the moccasins or sandals of prehistoric man were shaped. — (*Acad. nat. sc. Philad.; meeting* Feb. 5.) [342

PSYCHOLOGY.

Apparent size of magnified objects. — A paper (to appear elsewhere) was read by Prof. W. H. Brewer, in which he gave the results of several hundred estimates by as many different observers chosen from different classes of people, of a common insect as seen magnified by a microscope. These estimates were found to vary from a fraction of an inch to several feet, the actual apparent size at ten inches being a little over four inches. — (*Conn. acad. arts sc.; meeting*, Dec. 20.) [343

Experiments in binary arithmetic. — Simple addition involves several distinct but nearly simultaneous mental operations, and a capital of more than fifty propositions committed to memory. The object of the experiments by the author of the paper, Mr. Henry Farquhar, was to test the possibility of diminishing the mental strain, and consequent liability to error, by the use of numbers expressed in powers of 2, the mental work being reduced to counting similar marks and halving their sums. Columns of numbers of six or eight figures each were written with the ordinary, and with various forms of binary, notation; and comparative additions were made. To avoid confusion of columns it was found best to give different shapes to the marks denoting neighboring powers of 2; and, for brevity of expression, two or more of them were combined in one written figure. About seventy combinations were tried, with various results. With the best combination, addition required only three-fourths the time taken with ordinary figures; and this was reduced to one-half when the binary notation was taught to a person unskilled in arithmetic.

The only natural division is by bisections; hence the superior convenience of a binary scale of weights; and hence another reason for endeavoring to introduce a binary arithmetic.

In the discussion which followed, Mr. William B. Taylor said the world was losing so much by the use of the denary arithmetic, that even a single generation might find economy in substituting the octonary. The paper had especial value in that it proved the ability of binary arithmetic to compete with the established system in rapidity of computation. — (*Phil. soc. Wash.; meeting* Jan. 13.) [344

Varying the thermal background of reflex perception. — The background of conscious perception, physiologically speaking, is defined by W. T. Sedgwick as "that standard (usually unconsciously held) with which we compare any stimulus which awakens consciousness." We perceive difference of relative intensity between a specific stimulus and its background. The latter may vary so that a stimulus which will to-day cause consciousness or motion will not do so to-morrow. Instead of studying the reflex background by means of inhibitions, the author varies the background as a whole thermally, and observes its effect on reflexes. A reflex or headless frog may be heated so slowly, that, although the heart may beat very fast, *rigor caloris* may be caused without any motor re-action of its limbs. If the heart be tied beforehand, reflexes occur from gradual heating.

This the author thinks explained by assuming, that, in the first case, the hot blood passing inward equalizes the progressive heating throughout, or changes the thermal background; while in the second case, with no circulation, the background is fixed, and the surface temperature rises to the point of difference which causes movement. — (*Johns Hopk. univ. circ.*, Feb., 1883.) G. S. H. [345

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

National museum.

Manitoba fishes. — A collection of fishes from Manitoba, the first received for twenty years, shows that the fish-fauna of that region does not differ materially from that of the lake states.

Number of visitors in 1882. — The reports of the doorkeepers, which have been regularly made since Feb. 8, 1882, show that the average daily attendance at the museum building for that year was 535 persons, and, at the Smithsonian building, 488 persons. Estimating upon this basis, the attendance for the year 1882 may be placed at 183,265 for the museum building, and 152,822 for the Smithsonian building. When the re-arrangement of the collections in the latter

building is completed, the number of persons entering the doors will undoubtedly be the same as the number entering the museum building. The average daily attendance upon the museum at present is about 1,200.

Fisheries exhibit. — A preliminary display of the fisheries exhibit to be sent to London took place in the halls of the museum on the evenings of the 26th and 27th insts. About five thousand invitations were distributed by the commissioner of fisheries for the first evening, and were universally responded to. On the second occasion the general public was admitted without reserve. The exhibit may be pronounced remarkably comprehensive in scope, and complete in detail. The mounting of the various objects has been done in a very careful and artistic manner. Packing will begin at once.

Geological survey.

Division of mining statistics and technology. — According to an act of Congress passed at the last session, the survey is charged with the duty of collecting and publishing statistics of the mineral industries of the country (other than gold and silver mining). The plan also includes technical discussions and industrial notes; the general aim being to furnish matter of a practical character, thus correlating the purely geological work of the survey. The reports are to be issued as semi-annual bulletins, in octavo, the first of the series bearing date of July 1, 1883.

The scope of this work embraces a wide range of topics, among which are coal, iron, petroleum, copper, lead, zinc, quicksilver, nickel, tin, manganese, antimony, bismuth, salt, graphite, phosphates, barytes, asbestos, borax, gypsum, sulphur, mica, felspar, and many other substances; together with lists of localities of the useful minerals, statistics of mine accidents, etc.

Although mining statistics have been for many years published as government reports in Great Britain, France, Belgium, Holland, Russia, Germany, Austria, Sweden and Norway, Victoria, New South Wales, Queensland, Nova Scotia, and other countries and colonies, the United States have been hitherto without accounts of their mineral products, excepting such as are included in the reports of mining commissioners for the precious metals, state mineralogists, state geological surveys, and in census returns and the commercial reports of the bureau of statistics. While much creditable work has been done, and valuable information imparted, in a desultory way, both have been limited by local restrictions, or have wanted continuity. The general government has never before attempted systematic effort in this direction.

Bureau of ethnology.

Explorations of the pueblos of Tusayan. — During the earlier part of the past field-season, one of the parties of the bureau, under the charge of Mr. Victor Mersdeleff, has been at work among the pueblos of the ancient province of Tusayan, making such measurements, drawings, and plans, as will enable him to prepare models of the seven Moqui towns, on a scale sufficiently large to exhibit not only the architectural details of the villages themselves, but also the essential features of the high, precipitous mesas upon which they stand.

The party first visited the towns of Té-wa, Sechum-o-vi, and Wol-pi, — all built, in the order named, on one mesa promontory.

It is an interesting fact that the inhabitants of Té-wa, although in such close proximity to the other towns, have preserved their own customs and institutions in many respects entirely distinct from their neighbors. They manufacture a certain quality of undecorated pottery, which is not found at any other of the Moqui towns. It will be well represented in the collections from this region.

Wol-pi is remarkable for the position it occupies on the extreme point of the mesa peninsula, the neck connecting it with the main body of the mesa being not more than twelve feet wide. It is the largest of the three villages; and the small, rocky promontory on which it is built is well crowded with clusters of dwellings. In many cases, a back wall is built within a few inches of the edge of the vertical precipice; and the weathering and undermining of the rock has, in some instances, disturbed the foundations of the homes, compelling their abandonment. The trails from these villages to the plains below are very steep and rugged, in some cases descending by means of rude steps in crevices between the rocky wall of the mesa, and detached slabs of rock that have fallen from above.

The next field studied was the town of O-rai-be, which is by far the largest of the entire group, and the most isolated, maintaining very little intercourse with strangers. This pueblo is arranged with much regularity, considering the extent of ground it covers. The vast, irregular, hive-like cluster of houses usually seen in other pueblos is not found here. The buildings are arranged approximately in rows, and never exceed four stories in height. The fact that several additions to houses were being built during our short stay would seem to indicate that these people are increasing.

The three towns of the 'middle mesa' were the last group visited. Two of them — Mé-shong-i-ni-vi and Shi-pau-a-lu-vi — are quite close together; while Shong-a-po-vi, the third, is on a spur of the same mesa, three miles to the westward. The latter is the most regularly planned of all the towns. Entrance from the roof — a conspicuous feature in the architecture of more exposed pueblos — is here found only on the first mesa, and then only occasionally, many houses being unprovided with them. The natural inaccessibility of these villages would seem to render this precaution unnecessary. It is a noteworthy fact, that, in almost every instance, the terraced side of the houses, with all the doors and windows, face eastward; the back of each row usually being a vertical wall without receding stories, and with very few openings. Even when parallel rows occur, they occupy the position stated above, instead of being built facing each other.

Incidentally to the work among these pueblos, the party visited and surveyed the ruins of a very extensive ancient pueblo, situated ten miles east of the first Moqui mesa, and known by the Navajo name of 'Talla Hogan.' From the data collected, models can be made which will be accurate as to the relative position and size of minor features; such as doors, chimneys, ladders, etc.

Upon the completion of the surveying-work, Mr. Frank H. Cushing joined the party, and a collecting expedition was organized to work among these Indians. In addition to a very full and complete collection of the modern pottery, baskets, and dance-paraphernalia, there were secured many pieces of ancient ware of rare form and decoration, and in a perfect state of preservation. The Moquis stated that some of these had been dug up on the sites of ancient pueblos; and, indeed, many of them bear evidence of recent exhumation. A few, however, seemed to be considered as heirlooms. Some of the villages appear to entertain reverence for certain ruin

sites, — so much so, that the prospect of gain cannot induce them to collect any of their ancient remains, or to reveal the location of these ruins to the white man. Other ruins they explore as thoroughly as their rude means will permit, without any compunction.

Stone implements, and stone images of animals, used as fetiches, were also collected. Many specimens of basket-ware — some of types not made by the present pueblos — were secured. The art of basket-making flourishes best among the O-rai-bes, who exchange their products for the pottery of the other villages. Most of these are made in the form of flat, circular trays, of two styles of manufacture, — one a wooden variety, very light, made by the people of O-rai-be only; the other type, coiled spirally, and much stronger and heavier, is made by both the O-rai-bes, and the inhabitants of the villages on the middle mesa.

A large number of brightly decorated wooden images — representations of gods presiding over various dances — were collected. Some of these had been deposited at a sacrificial shrine that was discovered in the vicinity of Mē-shong-i-ni-vi.

PUBLIC AND PRIVATE INSTITUTIONS.

State university of Kansas, Lawrence.

Weather report for February. — Although the lowest temperature of this month was one degree lower than any previous February minimum of our sixteen-years' record, its mean temperature was not so low as in 1874, 1875, and 1881. The mean height of the barometer exceeded every previous monthly mean. The rainfall was nearly double the average; and this is but the third month in the past year in which the rainfall has reached the average. The cloudiness and humidity were much above the average, while the wind-velocity and depth of snow were normal. Before the ice 'broke up' in the Kansas river in the middle of the month, it had reached a thickness of twenty inches.

Mean temperature, 27.92°, which is 5.64° below the average February temperature of the fifteen preceding years. The highest temperature was 67°, on the 28th; the lowest was 13° below zero, on the 4th; monthly range, 80°. The mercury fell below zero on three days. Mean temperature at 7 A.M., 21.34°; at 2 P.M., 34.44°; at 9 P.M., 27.96°.

The winter now closing, although cold, has been less severe than the winters of 1872–73, 1874–75, and 1880–81.

Rainfall, including melted snow, 2.31 inches, which is 1.05 inches above the February average. Rain or snow, or both, fell on ten days, on one of which the quantity was too small to measure. The depth of snow was 4 inches. The entire depth of snow for the winter has been 14¼ inches. There was one thunder-shower, with sleet, on the 3d.

Mean cloudiness, 51.67 % of the sky, the month being 5.98 % cloudier than the average. Number of clear days (less than one-third cloudy), 12; entirely clear, 3; half-clear (from one to two thirds cloudy), 5; cloudy (more than two-thirds), 11; entirely cloudy, 7; mean cloudiness, — at 7 A.M., 55.36 %; at 2 P.M., 55.71 %; at 9 P.M., 43.93 %.

Wind, N.W. 29 times, S.W. 26 times, N.E. 24 times, S.E. twice, S. once, N. once, E. once. The entire distance travelled by the wind was 10,593 miles, which gives a mean daily velocity of 378 miles, and a mean hourly velocity of 15.76 miles. The highest velocity was 50 miles an hour, on the 24th.

Mean height of barometer, 29.340 inches; at 7 A.M., 29.340; at 2 P.M., 29.332; at 9 P.M., 29.348; maximum, 29.869, at 9 P.M., on 17th; minimum, 28.492, on 15th, at 2 P.M.; range, 1.377 inches.

Relative humidity: mean 77.9, at 7 A.M. 85.8, at 2 P.M. 64.9, at 9 P.M. 83.0; greatest, 100, on ten occasions; least, 41, on 19th.

The following table furnishes a comparison with preceding years:—

February.	Mean Temperature.	Maximum Temperature.	Minimum Temperature.	Inches of Rain.	Mean Cloudiness.	Mean Humidity.	Miles of Wind.	Inches of Snow.
1868	35.71	72.0	*—3.0	0.19	24.71	.....	.....	0.50
1869	30.03	66.0	—5.0	1.44	51.20	83.1	.....	5.25
1870	35.42	69.0	—4.0	0.08	43.69	61.6	.....	0.00
1871	35.30	71.5	—6.0	2.43	49.85	74.3	.....	4.00
1872	30.44	62.0	—12.0	0.82	54.94	70.4	.....	7.75
1873	30.26	62.0	—6.5	0.86	45.96	68.1	12,827	3.00
1874	27.06	49.0	2.0	0.95	60.94	78.2	9,195	10.00
1875	21.92	55.0	—8.0	0.80	50.48	74.7	11,865	4.00
1876	37.80	74.5	—5.0	0.36	38.16	69.0	15,236	0.25
1877	39.65	66.0	21.0	0.80	47.13	71.8	7,718	2.00
1878	40.22	66.0	15.6	2.89	54.63	78.5	7,393	2.50
1879	34.06	74.0	5.0	0.41	39.04	64.7	10,097	4.50
1880	37.58	64.0	8.0	0.73	24.94	61.5	11,861	0.00
1881	25.78	61.5	—5.5	4.60	54.17	79.8	12,142	22.00
1882	41.65	73.0	12.0	1.66	45.49	69.7	11,907	2.00
1883	27.92	67.0	—13.0	2.31	51.67	77.9	10,593	4.00
Mean of 16 Februaries	33.21	66.0	—0.29	1.33	46.06	71.7	10,901	4.49

* The minus-sign denotes temperature below zero.

Peter Redpath museum of McGill university, Montreal.

Logan memorial collection. — This includes: 1°. Series of large slabs of Protichnites and Climactichnites, collected by Mr. Richardson at Perth, Ont. 2°. Collection of graptolites and trilobites from the Quebec group, collected by Mr. Richardson at Lévis and Matane. 3°. Cast of skeleton of Megatherium Cuvieri, cast of skull of Mastodon, footprints of dinosaurs, and other large casts of fossils, purchased of

Messrs. Ward & Howell. 4°. Collection of animals especially illustrative of geology. 5°. Large slabs of Laurentian limestone, with Eozoon canadense.

The whole of these are labelled 'Logan memorial collection,' and a large commemorative inscription is attached to the support of the skeleton of Megatherium.

Carpenter collection of Mollusca. — This magnificent collection now appears with all the advantages of ample space and light; the four table cases occupied in the old museum having been increased to eight, with upright cases for the larger specimens and alcoholic preparations. In the process of removal, the arrangement has been carried out in the manner originally contemplated by Dr. Carpenter; and all the tablets have been carefully gone over by Mr. Curry, and cleaned, and loose specimens re-cemented; while additional species have been mounted or removed from the drawers to the glass cases, so as to render the exhibited collection more complete. The collection is now in excellent condition, and thoroughly available for scientific use, and, it is hoped, is so protected that it will remain free from dust or other injury for an indefinite period.

Collections of Principal Dawson. — These include: 1°. Specimens of Eozoon canadense and illustrative forms, as Stromatopora, etc. 2°. Cambrian fossils from New Brunswick, etc. 3°. Upper Silurian fossils from Nova Scotia, Gaspé, etc. 4°. Devonian plants and fishes from Gaspé, New Brunswick, Maine, etc. 5°. Carboniferous reptiles, fishes, insects, millipedes, crustaceans, shells, etc., mostly from Nova Scotia. 6°. Carboniferous plants, principally from Nova Scotia and New Brunswick. 7°. Post-pliocene fossils of Canada, with additional specimens from the United States and Europe. 8°. Recent shells dredged in the Gulf and River St. Lawrence, illustrating the modern fauna and the post-pliocene fossils. Also collections of Canadian crustaceans, hydroids, bryozoons, sponges, etc. 9°. Miscellaneous collections of Canadian and foreign fossils, rocks, etc.

The whole of these specimens are disposed in their places in the general collection, with the exception of the fossil plants and recent shells, which are in separate cases. They include the greater part of the types of the species described or catalogued by Dr. Dawson, and many of the specimens are unique.

Illinois state laboratory of natural history, Normal.

Distribution of school collections. — This institution, which seems to be unique in some of its characters, makes regular provision for the supply of small synoptical collections in zoölogy to the public high schools of the state. A distribution recently closed includes 10,170 specimens of pinned insects, representing 529 species, belonging to all the orders except Diptera; 2,350 alcoholic specimens of Illinois fishes, belonging to 71 species; and 890 echinoderms, coelenterates, and other aquatic invertebrates in alcohol. Similar collections were issued two years ago, the present distribution completing the supply of all the public high schools of Illinois in which zoölogy is taught as a regular study of the course. It is interesting to note that the number of high schools in which this subject is systematically studied is between seventy and eighty.

NOTES AND NEWS.

— The treasurer of the Balfour memorial fund acknowledges the following subscriptions: Thomas J. Clarke, New York, $2; Henry Sewall, Univ. Michigan $15,; C. V. Riley, Agric. Dept., Washington, $5; C. E. Hanaman, New York, $25; Dental classes 1883 and 1884, Univ. Michigan, $6; O. C. Marsh, New Haven, $25; Alex. Agassiz, Cambridge, $50; Henry Holt, New York, $10; previously acknowledged, $247.

— Peter Merian died last month at Basel, his native town, at the age of eighty-seven, having been born in 1795. After studying at Paris from 1817 to 1819 under Cuvier, Brongniart, and Geoffroy St. Hilaire, Merian returned to Basel, and began at once the study of the geology of the Swiss Jura, and the formation of one of the best collections of fossils now in existence. Attached to the university of his native place as professor of physics and chemistry, then as rector, and finally as professor of geology, he devoted nearly all his time to the development and progress of the museum of natural history, which is mainly his work. There he first classified the large and important family of Ammonites, separating them into groups according to their external forms. During a visit from Leopold von Buch (the great Prussian paleontologist and geologist, engaged then on his monograph of the Ammonitidae), this *savant* was not a little impressed to find that Merian had anticipated his classification in all the main points. From that time a most intimate friendship existed between the two men until the death of von Buch in 1853. By its central position in western Europe, Basel was a place of necessary detention for all travellers, especially before the construction of railways; and few travelling geologists have passed through it without visiting the museum of Peter Merian. Rarely absent, very hospitable, having inherited a large estate, he gladly received at his table in town or at his country-place all who called on him. Scientific men certainly are not always rich, nor always most particular in their dress or manners; yet all, rich or poor, well or shabbily clothed, were received with equal cordiality. His wife, however, somehow came to the conclusion that all scientific men were a ragged or extraordinary set, even the rich; such, for instance, as Leopold von Buch, always so odd, the absent-minded Charles Lyell, the original Ami Boué, or the stiff and formal Elie de Beaumont. One day, in 1846, a young geologist presented himself at the museum, taking notes of all the fossils. Merian, struck by the application and good air of the foreigner, asked him to dine with him; "because," said he, "Madame Merian is always reproaching me for bringing home the most indecorous and rough-looking set of fellows; and I shall be glad to show her one man at least on whom she will look without contempt."

Merian never published much; but all his memoirs are very suggestive and important. The first was on the Jurassic formation in the canton Basel. It appeared as long ago as 1821, and was completed in 1826 by a new survey of the cantons of Basel and

Solothurn. Of the last, Jules Thurmann, the author of the classification of the remarkable orography of the Jura mountains, says, "La coupe de M. Merian fut pour moi un vif trait de lumière, qui me donna sur le champ la clef du dédale où mon imagination avait souvent cherché un fil conducteur." The Black Forest was also carefully studied by Merian. Finally, in company with his friend, the late Escher von der Linth, he solved that vexed problem, the geological age of the celebrated formation of St. Cassian in the Alps. Merian was a great friend of Agassiz, who published his fossils in his *Poissons fossiles, Echinodermes de la Suisse* and *Monographie des myes;* and he was among the first to accept the theory of glaciers and a 'glacial epoch.'

—Those who have profited by Troschel's valuable work, *Das gebiss der schnecken*, will be glad to know that it is not to be left incomplete by the author's death. The publishers, at the suggestion of Professor von Martens, have made arrangements with Herr Schako of Berlin to carry the work on at least to the end of the Rhiphidoglossa, and perhaps through the Docoglossa. Time will determine whether a still farther extension of its scope will be practicable. Professor Troschel left no unpublished manuscript, but a certain number of unfigured preparations; while the whole series previously figured are in good condition, mounted on microscopic slides, and form a large and valuable collection, now at Berlin.

—The American academy of arts and sciences held an adjourned stated meeting on Wednesday, Feb. 14. Louis Pasteur was elected as foreign honorary member in place of the late Charles R. Darwin, and Matthew Arnold as foreign honorary member in place of the late Arthur P. Stanley. The following papers were presented: Quantitative researches in photography, by William H. Pickering; Photography as a means of determining the light and color of the stars, by Edward C. Pickering and William H. Pickering; On the historical hydrography of the west coast of North America, by Justin Winsor.

—The Philosophical society of Washington, at its meeting Feb. 24, listened to papers by Prof. J. W. Chickering, on the Thermal belts of North Carolina; by Mr. G. K. Gilbert, on The response of terrestrial climate to secular variations in solar radiation; and by Capt. C. E. Dutton, on The geology of the Hawaiian islands.

—The National academy of sciences will hold its annual meeting in Washington, April 17 and succeeding days, and, on the last day of the session, witness the unveiling of the statue of Professor Henry, by Story, upon the Smithsonian grounds.

—At a meeting of the section of chemistry and physics of the Ohio mechanics' institute, March 1, papers were presented on the Discovery of a method for iridium-plating, by Prof. William L. Dudley; Studies in chemical dynamics (abstract from Ostwald); the Phosphides of platinum, and a Chemical theory of odors, by Prof. F. W. Clarke. The latter provoked considerable discussion.

At a meeting of the section of mechanics and engineering, Feb. 27, Mr. J. G. Danks read a paper on the History of the mechanical puddling-furnace.

—Those of our readers who happen to live at a little distance from the heart of a city must frequently have noticed a lack of accord between the readings of their own standard thermometers and the published observations of the signal-service observer of their locality. The reason of the discord is plain; viz., the perturbing action of the heat which the city emits: and, however gratifying it may be to the outsider to find himself superior to the government observers, it is very little to the credit of the weather bureau that this particular source of error was not long since recognized and avoided. From the scientific point of view, it is simply lamentable that many an old suburban fogy, operating, perhaps, with a shilling thermometer, is to-day getting better observations of minimum temperatures — observations which, poor and incomplete as they are, are really more accurate, and which would in the future be more useful if they could only be preserved and published — than the U. S. signal-service observers can obtain within the city, in spite of their training and prestige, and of their perfected instruments and appliances.

The remarks of Professor Whitney on this subject, as applied to observations made at London, are so pertinent and convincing, and they bear so directly upon our own city of Boston, that we quote them here as a just expression of scientific opinion. In his 'Climatic changes of later geological times' (p. 228), while criticising certain conclusions of Glaisher, Professor Whitney says, —

> "It is a well-known fact, that cities are considerably warmer than the more thinly inhabited country, otherwise under similar climatic conditions. Statistics prove this to be true; and there could be no doubt that such would be the effect of an immense aggregation of population within a limited space, even if there were no statistics bearing on this question. Many millions of tons of coal are burned in and about London during every year; and the whole mass of brick of which the city is built is heated during the entire winter, and more or less in the summer, many degrees above the natural temperature. There can be no question that conditions such as are here indicated vitiate all observations made in or near large cities, with a view to the determination of any possible secular variation of the temperature." It is to be regretted that "most of the longer records of temperature come from observatories situated either within or very near to cities where the conditions have not remained the same, but have been rapidly changing, and in such a way, we have good reason to believe, as to produce a decided effect on the temperature."

—Dr. G. Steinmann, privat docent at the Deutschland university of Strassburg, writes from the Straits of Magellan, under date of Dec. 23, that he has explored the whole Brunswick peninsula (Tierra del Fuego), and that at Mount Tarn, Port Famine, he

has collected the Crioceras simplex, as Darwin did, besides other cretaceous fossils, several of them new to science. He found the southern extremity of the Cordilleras to be formed wholly of cretaceous strata, mainly of neocomian age. The strata are very complicated, and recalled to his mind the neocomian of the French Alps, near Escragnolles (Var.).

— An entertainment fund has recently been endowed in the Philadelphia college of physicians by Dr. S. Weir Mitchell. The income is to be used, under the direction of a standing committee, to defray the expenses of occasional receptions, at which refreshments suited to the dignified character of the society are to be provided. It is proposed to issue invitations not only to members of the college and other physicians, but also to laymen who may be identified with the intellectual welfare of the city.

— We regret to learn that Mr. Alexander Murray, director of the Geological survey of Newfoundland, owing to illness and old age, is obliged to relinquish field-work, and to retire altogether, his medical adviser having recommended him to go to a milder climate. Mr. Murray is one of the pioneers of American geology, having commenced as the first and only assistant on the Geological survey of Canada when it was organized in 1842, and then as director of the survey in Newfoundland since 1864. His assistant, Mr. J. P. Howley, will continue the survey of the island.

— There has been an unusual awakening in scientific circles in Cincinnati this winter; a polytechnic school has been organized; a state forestry association formed, with its headquarters in Cincinnati; and courses of popular lectures on chemistry, zoölogy, botany, and history, have been given at the Afternoon school in popular science and history.

— The students of the Institute of technology in Boston propose to place in the entrance-hall of the building a bronze tablet in memory of the late Professor William B. Rogers. The committee in charge of the matter recommend that it be peculiarly a student memorial, and that the sum required for its erection be raised by contributions from the students exclusively.

— Dr. F. G. Hahn gives a favorable review of A. Penck's *Schwankungen des meeresspiegels* (*Ausland*, 1883, 91). The review calls attention to previous suggestions by Bruchhausen, Stokes, and others, of unevenness of the sea-surface caused by continental attraction, and thinks that the departure of the ocean's surface from the theoretic spheroid may be as much as 1,000 or even 1,500 metres.

— According to official returns, there were in Australasia in 1880, 75,237,917 sheep, 8,104,786 cattle, 1,206,100 horses, 1,026,898 pigs. Forty-seven per cent of the sheep were owned in New South Wales.

— Dr. Ritzema, in the 'Versleg van den landbouw in Nederland,' highly compliments the work of the entomological division of the Department of agriculture.

— The ninth and tenth parts of the *Geologische tabellen und durchschnitte* of the St. Gotthard tunnel have appeared.

— At the meeting of the Biological society of Washington, March 2, Prof. O. T. Mason gave a paper on the Human fauna of the District of Columbia, which was an exceedingly interesting review of the constitution of the population of the district, the nationalities represented, the percentage of crime and disease in each nationality, etc., derived from a study of the records of the census, the health-office, and the police-service. Dr. M. G. Ellzey read a paper on Hybrid sterility.

— At the meeting of the Boston society of natural history, March 7, Prof. G. Fred. Wright of Oberlin read a paper on the Glacial phenomena of Ohio, and Prof. A. Hyatt proposed for the whole range of the sciences which directly treat of the earth and its products, whether organic or inorganic, the term 'Physiognosy.'

— No work upon anthropology of recent date has invaded a more unworked field, or has cultivated its area with more thoroughness, than Col. Mallery's 'Sign language.' The most flattering notices have appeared in many of the foreign journals; and a translation into the German language has been made by Agnes Brauer, bearing the title: Forschungen und anregungen über die zeichensprache der Indianer Nord-Amerikas. Von Garrick Mallery. Uebersetzt von Agnes Brauer. Mit Anmerkungen von Wilhelm Keil. Sonderdruck aus den Mittheilungen des vereins für erdkunde zu Halle, a.-S., 1882 (Halle a-S., 1882).

— At the meeting, yesterday, of the Society of arts of the Massachusetts institute of technology, Mr. H. A. Hill described the Cummer steam-engine, and Mr. F. C. Childs exhibited and described the new and sensitive electro-thermostat of the Automatic fire-alarm association.

— The 47th Congress included in its appropriation bills several items for the U. S. geological survey. They amount in total to $341,140, and are available during the fiscal year beginning July 1, 1883. This is $82,700 greater than the appropriation for the current fiscal year.

— Dr. H. O. Marcy has again brought to public notice the researches of Ercolani on the placenta, by publishing in the *Annals of anatomy and surgery* for November, 1882, a well written abstract of a part of the results of the Italian embryologist. Under the designation of "A unity of anatomical and physiological modality in all vertebrates," he also renews the familiar comparison between the absorption of food by the blood-vessels from the yolk and from the placenta.

— With the current number the *Quarterly journal of microscopical science* assumes a new dress. An enlarged page and better paper permit an improve-

ment in the typography, while the plates are also more capacious. The whole result is a higher excellence in all the material qualities of the journal, which is well matched by the worth and importance of the articles. Professor Lankester has been most successful in his management of this publication; for, when he began, its value was so much inferior to that it now has, that the progress is remarkable. What was the not very important organ of amateurs has become a leading journal.

— The death is announced, Dec. 7, of Mr. G. W. Belfrage, an assiduous collector of insects in Bosque County, Texas.

— A new natural history society has been organized at Trenton, N.J., with Prof. Ellis A. Apgar, state superintendent of public instruction, as president, and Dr. C. C. Abbott as secretary.

— In the year 1800 there was founded at Paris a society entitled 'La société des observateurs de l'homme.' While no one would expect to find such an organization invested with all the modern improvements, a perusal of their first instructions to observers will both gratify and agreeably astonish the student of to-day. The document appears in full in the January number of the *Revue d'anthropologie*, filling twenty-two closely printed pages.

— A plate reproducing the appearance of a part of the relief-map of France, by E. Guillemin, is given in *La Nature*, Jan. 6, 1883.

— The scientific results of the fourth polar voyage (1881) of the 'William Barents' are reviewed in *Ausland*, 1883, 61–68.

— Mr. Charles Henry Hart is the author of a memoir on Lewis H. Morgan of Rochester, N.Y., read before the Numismatic and antiquarian society of Philadelphia, May 4, 1882, and published by the society. The works of Mr. Morgan are briefly reviewed; but a bibliography, which would be of great service to students of anthropology, is wanting.

— In article 189 of our 'Summary,' the reading should be: "as has been done by M. Marey in his 'photographic gun,'" and not 'photographic sun.'

RECENT BOOKS AND PAMPHLETS.

Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.

Buckley, A. B. Botanical tables for the use of students. *New ed.* London, *Stanford*, 1883. 12°.

Cameron, J. Gaelic names of plants, Scottish and Irish. London, *Blackwood*, 1883. 8°.

Dutton, Clarence E. Tertiary history of the Grand Cañon district, with atlas. Wash., *Government*, 1882 (U. S. geol. surv. — monogr. ii.). Text 264 p., 42 pl. 4°; atlas 23 pl. f°.

Echegaray, J. Teorías modernas de la física, unidad de las fuerzas materiales. *2a ser.* Madrid, *Gaspar*, 1883. 238 p. 8°.

Electricidad (La.) — Revista general de sus progresos científicos é industriales. Dir. Rojas. Año i. núm. 1, Barcelona. Enero, 1883. 12 p. 4°. (Bimonthly.)

Garrido Villasán, A. — Topografía militar. Madrid, *Guirnalda*, 1882. 135 p., 4 pl. 8°.

Greer, Henry. A dictionary of electricity or the electrician's hand-book of reference. N.Y., *Allison*, 1883. 192 p. 12°.

Guillaume, Dr. L'eau du Seyon et la fièvre typhoïde à Neuchâtel. Rapport présenté à la direction de l'intérieur au nom de la commission d'état de santé. Neuchâtel, *imp. Borel*, 1882. 60 p., 1 pl. 8°.

Heitzmann, C. Microscopical morphology of the animal body in health and disease. With 380 original engravings. N.Y., *Vail*, 1883. 19 + 849 p. 8°.

Hoffer, R. Practical treatise of caoutchouc and gutta percha. London, *Low*, 1883. 12°.

Hopley, Catherine C. Snakes: curiosities and wonders of serpent life. London, *Griffith*, 1883. 618 p. 8°.

Hunziker, O. Die übergangszeit des volksschulwesens der Schweiz. Zürich, *Schulthess*, 1883. 8°.

—— Vorgeschichte und anfänge des volksschulwesens in der Schweiz. Zürich, *Schulthess*, 1883. 8°.

Lawrence, W. T. Principles of agriculture. Stage 1-2; 2-3. Edinburgh, *Chambers*, 1883.

Marcet, W. The principal southern and Swiss health resorts; their climate and medical aspects. London, *Churchill*, 1883. 408 p. 8°.

Marshall, G. F. L., and **Nicéville**, L. de. — Butterflies of India, Burma and Ceylon; all the known species of rhopalocerous Lepidoptera, and allied species of neighbouring countries. Vol. i., part 1. London, *Quaritch*, 1883. 8°.

Martin, H. Newell, and **Moale**, William A. Handbook of vertebrate dissection. Part. ii. How to dissect a bird. N.Y., *Macmillan*, 1883. pp. 89-174. 4 pl. 12°.

McAdams, W. Antiquities of Cahokia, or Monks' Mound in Madison County, Illinois. Edwardsville, Ill., 1883. 13 p., plates. 4°.

Mendive, José. Elementos de cosmología. Valladolid, *Viuda*, 1882. 150 p. 4°.

Modet y Riglos, Andrés. Ensayo sobre el establecimiento y la conservación del catastro en España. Precedido de un prólogo de A. Blanco. Madrid, *Murillo*, 1882. 16+403 p., 3 pl. 4°.

Nasmyth, J. Engineer; an autobiography; ed. by Samuel Smiles; with a portrait by George Reid and numerous illustrations. London, *Murray*, 1883. 468 p. 8°.

Newcomb, Simon. Popular astronomy. *2d ed. revised.* With 116 engravings and 5 maps of the stars. London, *Macmillan*, 1883. 596 p. 8°.

Pinner, Adolph. An introduction to the study of organic chemistry. Transl. and revised from the fifth German edition by Peter T. Austen. N.Y., *Wiley*, 1883. 19+403 p. 16°.

Pocock, R. The Gravesend historian, naturalist, antiquarian, botanist and printer; by George M. Arnold. London, *Low*, 1883. 276 p. 8°.

Report of the Smoke abatement committee, 1882; with reports of the jurors of the exhibition at South Kensington, and reports of the testing engineer, to which are added the official reports on the Manchester exhibition, 76 plates of illustrations, and 34 tables of results of tests of heating and cooking grates and stoves, steam boilers, appliances, fuels, etc. London, *Smith & E.*, 1883. 4°.

Ridsdale, B. Scenes and adventures in great Namaqualand. London, *Woolmer*, 1883. 294 p. 8°.

Ridsdale, C. H. Chemical percentage tables and laboratory calculation. London, *Lockwood*, 1883. 80 p. 8°.

Spencer, Herbert. Education, intellectual, moral, and physical. *New ed.* London, *Williams & Norgate*, 1883. 168 p. 12°.

—— Principios de sociología, trad. por Eduardo Cazoria. 2 tom. Madrid, *Calleja*, 1883. 16+488 p. 4°.

Swindell, J. G., and **Burnell**, G. R. Rudimentary treatise on wells and well-sinking. *Rev. ed.*; with a new appendix on the qualities of water. London, *Lockwood*, 1883. 106 p. 12°.

Townsend, F. — Flora of Hampshire, including the Isle of Wight; or a List of the flowering plants and ferns found in the county of Southampton, with localities of the less common species. Illustrated with 2 plates and a map. London, *Reeve*, 1883. 544 p. 8°.

Triboulet, Maurice de. Cours de minéralogie générale et appliquée, professé à l'académie de Neuchâtel (1877-82). Neuchâtel, *Berthoud*, 1883. 264 p., 16 pl. 8°.

Westwood, T. and **Satchell**, T. — Bibliotheca piscatoria: a Catalogue of books on angling, the fisheries and fish culture; with bibliographical notes and an appendix of citations touching on angling and fishing from old authors. London, *Satchell*, 1883. 410 p. 8°.

Williams, F. S. — Our iron roads; their history, construction and administration. With numerous illustrations. *2d ed., rev.* London, *Bemrose*, 1883. 530 p. 8°.